ECONOMIC EFFECTS OF CRITICAL HABITAT DESIGNATION FOR THE CALIFORNIA TIGER SALAMANDER IN 20 CALIFORNIA COUNTIES

Prepared For

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I EXECUTIVE SUMMARY

I.1 PURPOSE AND APPROACH

On August 10, 2004, the U.S. Fish & Wildlife Service (Service) proposed critical habitat for the Central population of the California tiger salamander, *Ambystoma Californiense*, (CTS) pursuant to the Endangered Species Act of 1973. A total of 382,669 acres were designated in 20 California counties, from Yolo County in the north through Kern County in the south.[1] This report quantifies the economic impacts associated with the proposed designation of critical habitat. It does so by taking into account the cost of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat within the proposed boundaries. The report combines information on current and projected land uses within critical habitat areas with a defined economic model to calculate these impacts. This report also disaggregates individual critical habitat units defined by the Service to identify the sub-regions where most economic impacts occur.

The economic analysis considers both the economic efficiency and distributional effects that may result from species and habitat protection. Economic efficiency effects generally reflect opportunity costs associated with the commitment of resources required to accomplish species and habitat conservation and lost economic surplus resulting from reduced levels of economic activity. Distributional effects reflect which sectors of the economy experience changes in costs or revenues as a consequence of critical habitat.

I.2 REPORT ORGANIZATION

Following the Executive Summary is an outline of the analytical framework and approach used in the analysis and an overview of the socioeconomic conditions in the affected counties. The impacts to land development, public projects, and private activities are presented next, followed by an evaluation of the regional costs and impacts to small businesses.

I.3 DESCRIPTION OF HABITAT AND AFFECTED COUNTIES

The primary constituent elements used to determine suitable habitat fall into three categories: Standing bodies of fresh water (including natural and manmade (e.g., stock) ponds, vernal pools, and other ephemeral or permanent water bodies); upland habitats adjacent to breeding ponds that contain small mammal burrows; and barrier-free upland dispersal habitat between occupied locations.

The Service has designated approximately 382,669 acres across 20 counties. Table II-1: Summary of Critical Habitat Units by County and Region displays acres of critical habitat by county. A variety of economic activities are undertaken within the affected counties, from housing construction to farming. For profiles of the socioeconomic conditions in the affected counties, please see Section III.

[1] 50 CFR Part 17. Due to differences in GIS maps, the total acres value is slightly greater than the value listed in the Federal Register publication.

I.4 IMPACTS ON REAL ESTATE DEVELOPMENT

Critical habitat designation for the central California population of the tiger salamander is expected to have the largest impacts on real estate development. Critical habitat occurs in a number of rapidly growing areas. Regulatory requirements to avoid onsite impacts and mitigate offsite affect the welfare of both producers and consumers. Two scenarios are considered. In the base scenario, mitigation requirements increase the cost of development and avoidance requirements are assumed to reduce the construction of new housing. In this scenario, critical habitat is expected to impose losses of over $441 million relating to lost development opportunities. A second scenario, in which increased costs and the reduction in developable land are accommodated through densification, is also discussed.

Table I-1: Summary of Economic Effects of Critical Habitat Designation shows losses for each affected county under the two modeling scenarios. Alameda County is the most impacted in both cases. In the rationed housing scenario, impacts are in excess of $193 million for this county alone. The four most impacted counties are the same in both scenarios: Alameda, Contra Costa, Monterey, and Santa Clara. These counties appear to experience impacts that are significantly larger than is the case in other counties – nearly twice as large as the next most impacted county. The ten most impacted counties are identical under the two scenarios.

The impacts of critical habitat designation vary widely even within counties. That is, the impacts of designation are frequently localized. This finding is sensible from an economic point of view and is consistent with the teachings of urban economics. Housing prices vary over urban areas, typically declining as the location of the house becomes more remote. Critical habitat is not evenly distributed across the landscape, and large impacts may result if a particular area has a large fraction of developable land in critical habitat. Some areas have few alternate sites for development, or have highly rationed housing resulting in high prices. Any of these factors may cause the cost of critical habitat designation to increase.

The disaggregated spatial scale of the analysis permits identification of specific locations, or parts of individual critical habitat units, that result in the largest economic impacts. The maps contained at the end of this section are instructive in this regard. The maps identify the Census tracts within the counties where the impacts are predicted to occur. They appear in order of impact per county.

I.5 PUBLIC SECTOR ACTIVITIES

The California Department of Transportation is planning to undertake several projects to build, upgrade, and maintain the state's transportation network in areas of vernal pool critical habitat. After determining the number of affected critical habitat acres, the typical mitigation requirements were applied to determine the impacts on this type of activity. The total costs to transportation projects are estimated to be $4.9 million. This figure does not include the costs of project delays, as we lack information on benefits from these projects.

The report also considers potential impacts on the energy sector. This analysis examines planned power production facilities within the study area for proximity to proposed

critical habitat. It finds the sites fall into one of two categories: either they are too far from critical habitat to be affected, or are within or near habitat but have already completed the environmental mitigation process for vernal pools. In both cases, the incremental impacts of designation are zero; the regulation is not expected to impact energy production.

There are overlaps between critical habitat and land managed by the Department of the Defense, Bureau of Land Management, Bureau of Reclamation, the Forestry Service, the Fish and Wildlife Service, and the Bureau of Indian Affairs. After consideration and discussion with Service staff, it is determined that the impacts from designation on these organizations will be minimal.

I.6 Regional Economic Effects

Designation of critical habitat alters the level of economic activity. As a result, regulation has impacts that spread beyond the sectors directly affected. Indirect and induced impacts of the regulation are calculated using the standard IMPLAN model. Counties with the largest change in new residential home construction were included in this analysis. These counties consisted of Contra Costa, San Benito and Monterey. Critical habitat designation has little effect on the regional economy. New residential construction is reduced by approximately $2.6 million, which causes output in other industries to decrease by approximately $1.7 million. These combined reductions represent only 0.01 percent of the region's output. Included among the industries most affected are wholesale trade and architectural/engineering services.

I.7 Small Business Impacts

Critical habitat is not expected to result in significant small business impacts since revenue losses are less than one percent of total small business revenues in affected areas. From Sacramento permit data, it appears that large businesses greatly dominate greenfield development. It is estimated that no more than a single small business will be affected annually as a consequence of designation.

I.8 Summary Of Measured Impacts

The economic impacts of critical habitat designation vary widely among the 36 affected counties, and even within counties. The counties most impacted by the critical habitat designation include Alameda ($193 million), Contra Costa ($91 million), Monterey ($67 million), Santa Clara ($33 million), San Benito ($23 million), and Fresno ($15 million). Further, economic impacts are unevenly distributed within counties. Our analysis is conducted for each of the 80 affected census tracts, resulting in a high degree of spatial precision.

Table I-1: Summary of Economic Effects of Critical Habitat Designation

County	Surplus Lost	Public Projects	Total	Annualized Impact	Surplus Lost (Densification)
Alameda	$193,439,087		$193,439,087	$17,064,749	$165,845,407
Contra Costa	$90,998,938		$90,998,938	$8,027,716	$76,053,062
Monterey	$67,166,426		$67,166,426	$5,925,267	$52,197,848
Santa Clara	$33,100,709		$33,100,709	$2,920,068	$28,119,669
San Benito	$18,126,710	$4,914,545	$23,041,255	$2,032,646	$14,125,811
Fresno	$14,769,911		$14,769,911	$1,302,967	$11,782,461
Solano	$5,529,894		$5,529,894	$487,834	$6,366,429
Calaveras	$5,292,733		$5,292,733	$466,913	$4,992,687
Stanislaus	$4,697,119		$4,697,119	$414,369	$3,480,706
Merced	$3,351,736		$3,351,736	$295,682	$3,024,361
Madera	$1,815,686		$1,815,686	$160,176	$1,658,939
Yolo	$822,954		$822,954	$72,599	$811,506
San Joaquin	$743,307		$743,307	$65,573	$724,975
Tulare	$603,790		$603,790	$53,265	$651,824
Sacramento	$535,913		$535,913	$47,277	$507,018
Amador	$499,942		$499,942	$44,104	$462,702
San Luis Obispo	$34,906		$34,906	$3,079	$30,632
Kings	$31,530		$31,530	$2,781	$27,126
Mariposa	$29,581		$29,581	$2,610	$23,964
Kern	$11,674		$11,674	$1,030	$11,759
Total	**$441,602,546**	**$4,914,545**	**$446,517,091**	**$39,390,705**	**$370,898,884**

Sources: Critical Habitat Boundary Files, U.S. Fish and Wildlife Service; California Department of Transportation, Office of State Planning

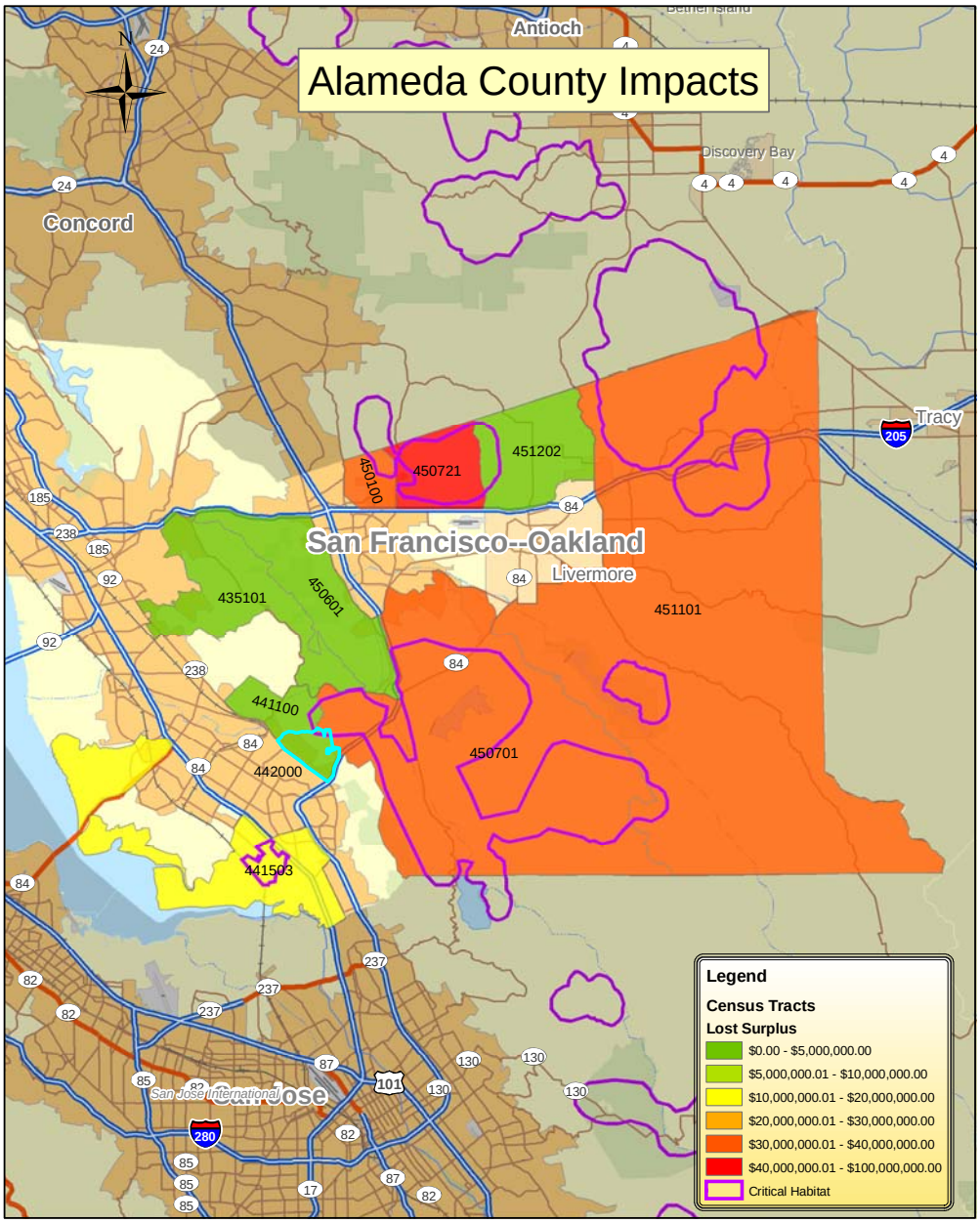

Figure 1: Alameda County Impacts

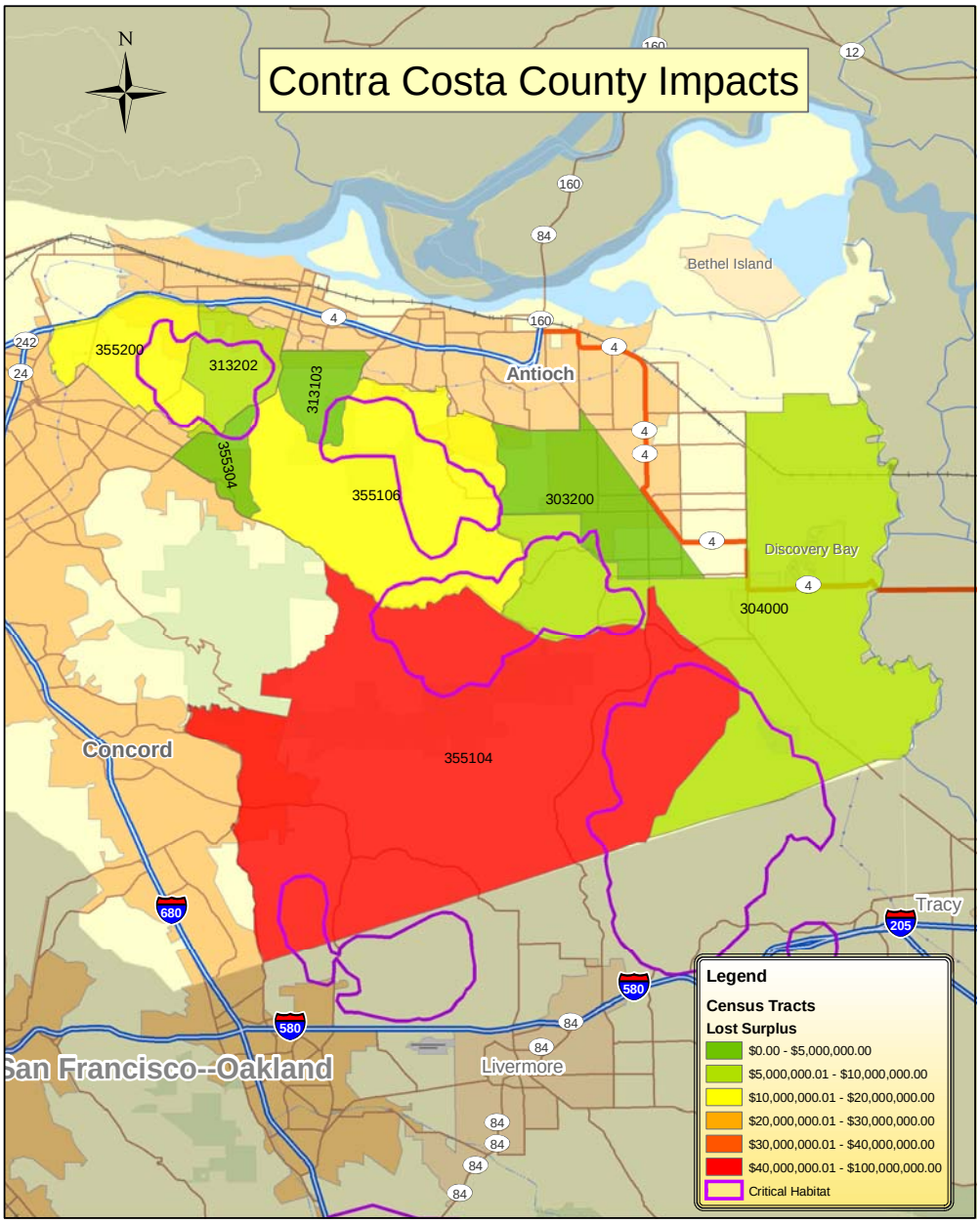

Figure 2: Contra Costa County Impacts

Figure 3: Monterey County Impacts

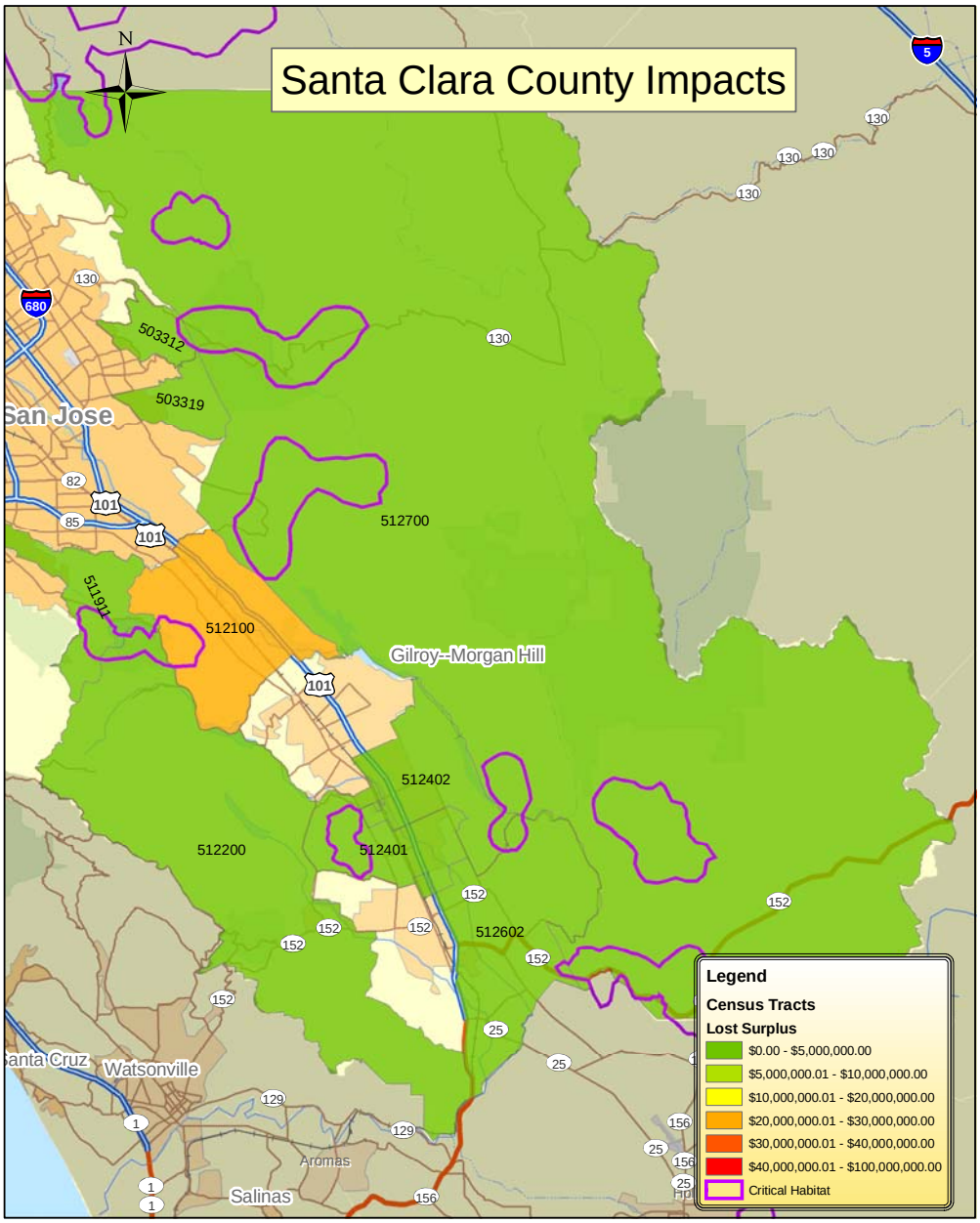

Figure 4: Santa Clara County Impacts

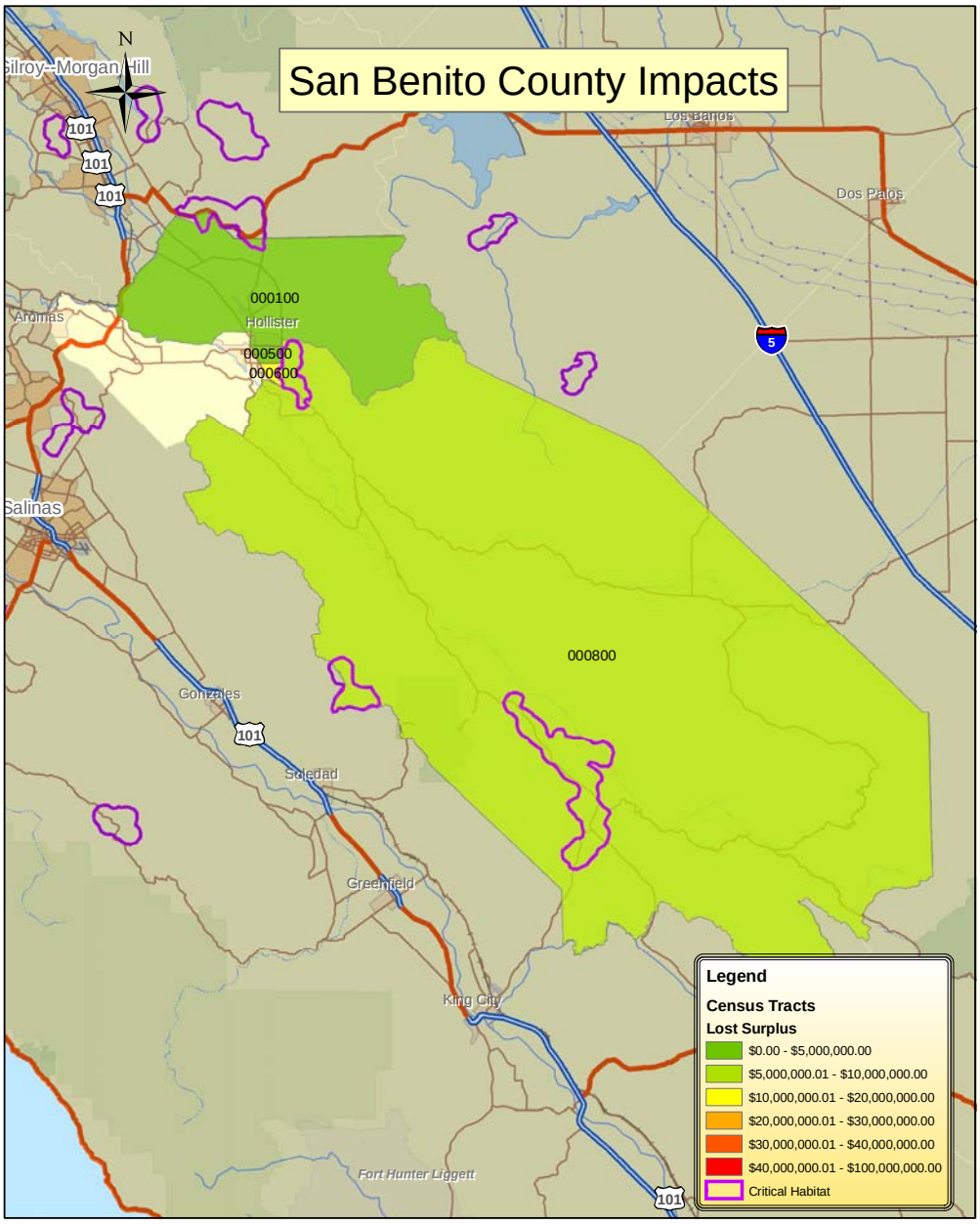

Figure 5: San Benito County Impacts, Including Transportation

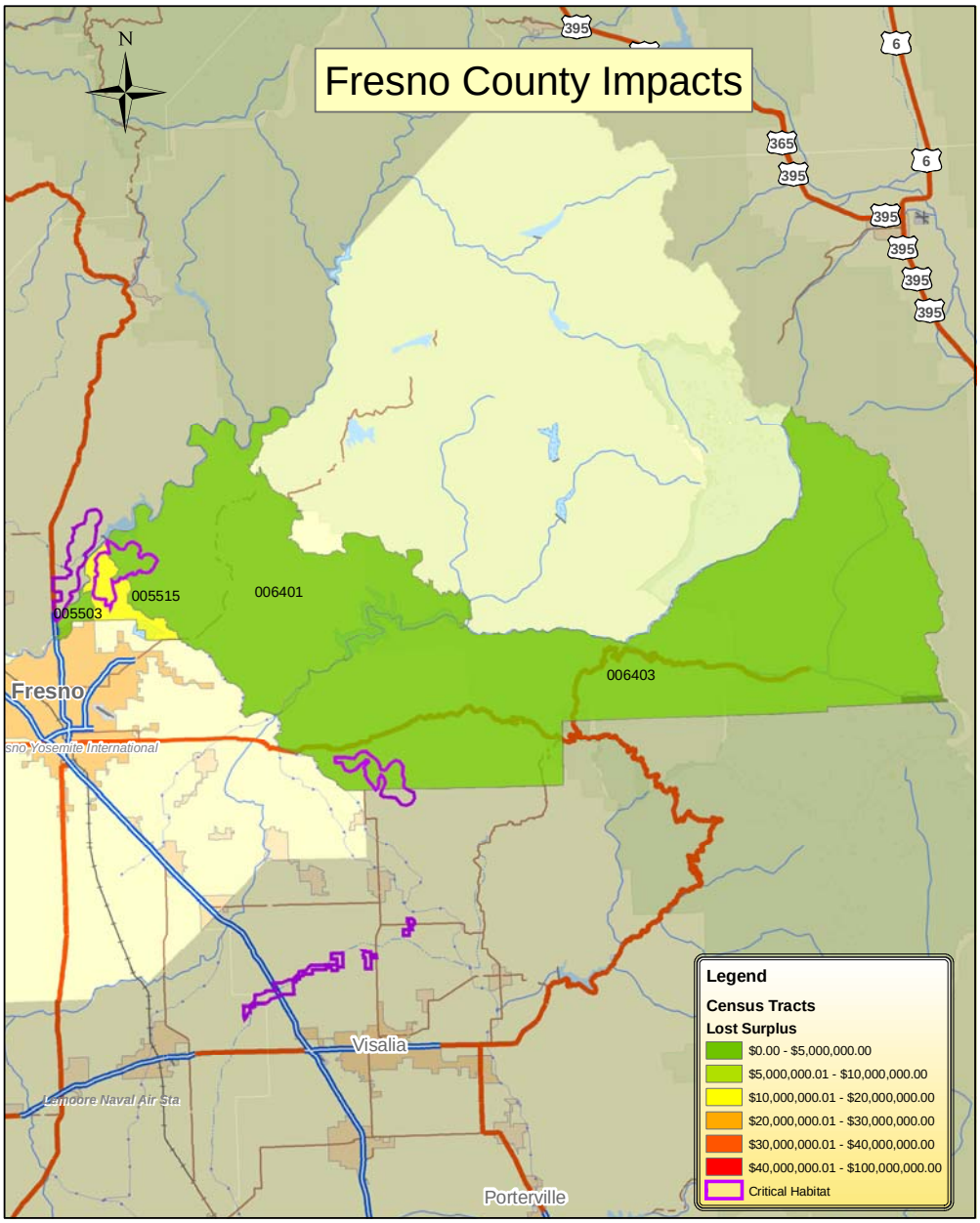

Figure 6: Fresno County Impacts

II REPORT BACKGROUND AND ANALYTICAL FRAMEWORK

II.1 REPORT PURPOSE

On August 10, 2004, the U.S. Fish & Wildlife Service (Service) proposed critical habitat for the Central population of the California tiger salamander, *Ambystoma Californiense*, (CTS) pursuant to the Endangered Species Act of 1973. A total of 382,669 acres were designated in 20 California counties, from Yolo County in the north through Kern County in the south.[2] This report quantifies the economic effects associated with the proposed designation of critical habitat. It does so by taking into account the cost of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat within the proposed boundaries. The report combines information on current and projected land uses within critical habitat areas with a defined economic model to calculate these impacts. This report also disaggregates individual critical habitat units defined by the Service to identify the sub-regions where most economic impacts occur.

This information is intended to assist the Secretary in determining whether the benefits of excluding particular areas from the designation outweigh the biological benefits of including them.[3] In addition, this information allows the Service to address the requirements of Executive Orders 12866 and 13211, and the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).[4] This report also complies with direction from the U.S. 10th Circuit Court of Appeals that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[5]

This section provides the framework for this analysis. First, it describes the general analytic approach to estimating economic effects, including both efficiency and distributional effects. Next, it discusses the scope of the analysis, including the link between existing and critical habitat-related protection efforts and economic impacts. Finally, it describes the information sources employed to conduct this analysis.

II.2 APPROACH TO ESTIMATING ECONOMIC EFFECTS

This economic analysis considers both the economic efficiency and distributional effects that may result from species and habitat protection. Economic efficiency effects generally reflect "opportunity costs" associated with the commitment of resources required to

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[2] 50 CFR Part 17. Due to differences in GIS maps, the total acres value is slightly greater than the value listed in the Federal Register publication.

[3] 16 U.S.C. §1533(b)(2).

[4] Executive Order 12866, "Regulatory Planning and Review," September 30, 1993; Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," May 18, 2001; 5 U.S.C. §§601 *et seq* ; and Pub Law No. 104-121.

[5] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001)).

accomplish species and habitat conservation. Efficiency losses also include reductions in surplus levels resulting from economic activities such as land development. Similarly, the costs incurred by a Federal action agency to consult with the Service under section 7 represent opportunity costs of habitat conservation.

This analysis also addresses the distribution of impacts associated with the designation, including an assessment of any local or regional impacts of habitat conservation and the potential effects of conservation activities on small entities and the energy industry. This information may be used to determine whether the effects of the designation unduly burden a particular group or economic sector. For example, while habitat conservation activities may have a small impact relative to the national economy, individuals employed in a particular sector of the regional economy may experience a significant level of impact. The difference between economic efficiency effects and distributional effects, as well as their application in this analysis, are discussed in greater detail below.

II.3 EFFICIENCY EFFECTS

At the guidance of the Office of Management and Budget (OMB) and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to discern the implications on a societal level of a regulatory action. For regulations specific to the conservation of the CTS, efficiency effects represent the opportunity cost of resources used, or benefits foregone, by society as a result of the regulations. Economists generally characterize opportunity costs in terms of changes in producer and consumer surplus in affected markets.[6]

In some instances, compliance costs may provide a reasonable approximation of the efficiency effects associated with a regulatory action. For example, a lead Federal agency may enter into a consultation with the Service to ensure that a particular activity will not adversely modify critical habitat. The end result of the consultation may be a small amount of additional mitigation for on-site impacts of the proposed activity. The cost of the additional mitigation would have been spent on alternative activities if the proposed project not been designated critical habitat. In the case that compliance activity is not expected to significantly affect markets – that is, not result in a shift in the quantity of a good or service provided at a given price, or in the quantity of a good or service demanded given a change in price – the measurement of compliance costs provides a reasonable estimate of the change in economic efficiency.

More generally, where habitat protection measures are expected to significantly impact a market, it may be necessary to estimate changes in producer and consumer surpluses. For example, a designation that precludes the development of large areas of land may shift the price and quantity of housing supplied in a region. In this case, changes in economic efficiency (i.e., social welfare) can be measured by considering changes in producer and consumer surplus in the real estate market.

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[6] For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see Gramlich, Edward M., *A Guide to Benefit-Cost Analysis (2nd Ed.)*, Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/ webpages/Guidelines.html.

II.4 Distributional and Regional Economic Effects

Measurements of changes in economic efficiency focus on the net impact of conservation activities, without consideration of how certain economic sectors or groups of people are affected. Thus, a discussion of efficiency effects alone may miss important distributional considerations. OMB encourages Federal agencies to consider distributional effects separately from efficiency effects.[7] This analysis considers several types of distributional effects, including impacts on small entities; impacts on energy supply, distribution, and use; and regional economic impacts. It is important to note that these are fundamentally different measures of economic impact than efficiency effects, and thus cannot be added to or compared with estimates of changes in economic efficiency.

Regional economic impact analysis produces a quantitative estimate of the potential magnitude of the initial change in the regional economy resulting from a regulatory action. Regional economic impacts are commonly measured using input / output models. These models investigate the effects of a change in one sector of the economy on economic output, income, or employment in other local industries. These economic data provide a quantitative estimate of the magnitude of shifts of jobs and revenues in the local economy.

Regional input / output models may overstate the long-term impacts of a regulatory change because they provide a static view of the regional economy. That is, they measure the initial impact of a regulatory change on an economy but do not consider long-term adjustments that the economy will make in response. For example, these models provide estimates of the number of jobs lost as a result of a regulatory change, but do not consider re-employment of these individuals over time or other adaptive responses by affected businesses. In addition, the flow of goods and services across the regional boundaries defined in the model may change as a result of the regulation, compensating for a potential decrease in economic activity within the region.

Despite these and other limitations, in certain circumstances regional economic impact analysis may provide useful information about the scale and scope of localized impacts. It is important to remember that measures of regional economic effects generally reflect shifts in resource use rather than efficiency losses. Thus, these types of distributional effects are reported separately from efficiency effects (i.e., not summed). In addition, measures of regional economic impact cannot be compared with estimates of efficiency effects, but should be considered as distinct measures of impact.

II.5 Scope Of The Analysis

This analysis identifies those economic activities believed to most likely threaten the listed species and its habitat and, where possible, quantifies the economic impact to avoid, mitigate, or compensate for such threats within the boundaries of the CHD. In instances where critical habitat is being proposed after a species is listed, some future impacts may be unavoidable, regardless of the final designation and exclusions under 4(b)(2). However, due to the difficulty in making a credible distinction between listing

[7] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

and critical habitat effects within critical habitat boundaries, this analysis considers all future conservation-related impacts to be coextensive with the designation.[8,9]

Coextensive effects may also include impacts associated with overlapping protective measures of other Federal, State, and local laws that aid habitat conservation in the areas proposed for designation. We note that in past instances, some of these measures have been precipitated by the listing of the species and impending designation of critical habitat. Because habitat conservation efforts affording protection to a listed species likely contribute to the efficacy of the CHD efforts, the impacts of these actions are considered relevant for understanding the full effect of the proposed CHD. Enforcement actions taken in response to violations of the Act, however, are not included.

II.5.1 Sections of the Act Relevant To the Analysis

The analysis focuses on activities that are influenced by the Service through sections 4, 7, 9, and 10 of the Act. Section 4 of the Act focuses on the listing and recovery of endangered and threatened species, as well as CHD. According to section 4, the Secretary is required to list species as endangered or threatened "solely on the basis of the best available scientific and commercial data."[10]

The protections afforded to threatened and endangered species and their habitat are described in sections 7, 9, and 10 of the Act, and economic impacts resulting from these protections are the focus of this analysis:

- Section 7 of the Act requires Federal agencies to consult with the Service to ensure that any action they authorize, fund, or carry out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the species' designated critical habitat. The administrative costs of these consultations, along with the costs of project modifications resulting from these consultations, represent compliance costs associated with the listing of the species and the designation of critical habitat.[11]
- Section 9 defines the actions that are prohibited by the Act. In particular, it prohibits the "take" of endangered wildlife, where "take" means to "harass, harm,

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[8] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (New Mexico Cattle Growers Assn v. U.S.F.W.S., 248 F.3d 1277 (10th Cir. 2001)).

[9] In 2004, the U.S. 9th Circuit invalidated the Service's regulation defining destruction or adverse modification of critical habitat (Gifford Pinchot Task Force v. United States Fish and Wildlife Service). The Service is currently reviewing the decision to determine what effect it (and to a limited extent Center for Biological Diversity v. Bureau of Land Management (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

[10] 16 U.S.C. §1533.

[11] The Service notes, however, that a recent Ninth Circuit judicial opinion, Gifford Pinchot Task Force v. United States Fish and Wildlife Service, has invalidated the Service's regulation defining destruction or adverse modification of critical habitat. The Service is currently reviewing the decision to determine what effect it (and to a limited extent Center for Biological Diversity v. Bureau of Land Management (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

pursue, or collect, or to attempt to engage in any such conduct."[12] The economic impacts associated with this section manifest themselves in sections 7 and 10.

- Under section 10(a)(1)(B) of the Act, an entity (i.e., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for an endangered animal species in order to meet the conditions for issuance of an incidental take permit in connection with the development and management of a property.[13] The requirements posed by the HCP may have economic impacts associated with the goal of ensuring that the effects of incidental take are adequately minimized and mitigated. The designation of critical habitat does not require completion of an HCP; however, the designation may influence conservation measures provided under HCPs. Federal agencies are not typically the sole stakeholder agency involved with development of an HCP. Federal agencies, however, can be the lead agency on a multi-jurisdictional HCP.

II.5.2 Other Relevant Protection Efforts

The protection of listed species and habitat is not limited to the Act. Other Federal agencies, such as the Army Corps of Engineers, as well as State and local governments, may also seek to protect the natural resources under their jurisdiction.[14]

CEQA is a California State statute that requires State and local agencies (known here as "lead agencies") to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. Projects carried out by Federal agencies are not subject to CEQA provisions. CEQA regulations require a lead agency to initially presume that a project will result in a potentially significant adverse environmental impact and to prepare an EIR if the project may produce certain types of impacts, including when:

> "[T]he project has the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory."[15]

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[12] 16 U.S.C. §1538 and 16 U.S.C. §1532.

[13] U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," http://endangered.fws.gov/hcp/.

[14] For example, the Sikes Act Improvement Act (Sikes Act) of 1997 requires Department of Defense (DOD) military installations to develop Integrated Natural Resources Management Plans (INRMPs) that provide for the conservation, protection, and management of wildlife resources (16 U.S.C. §§ 670a - 670o). These plans must integrate natural resource management with the other activities, such as training exercises, taking place at the facility.

[15] California Natural Resources Code §15065(a)

State law instructs the lead agency (typically a county or city community development or planning department in the case of land development projects) to examine impacts from a very broad perspective, taking into account the value of animal and plant habitats to be modified by the project. The lead agency must determine which, if any, project impacts are potentially significant and, for any such impacts identified, whether feasible mitigation measures or feasible alternatives will reduce the impacts to a level less than significant. It is within the power of a lead agency to decide that negative impacts are acceptable in light of economic, social, or other benefits generated by the project.

II.5.3 Additional Analytic Considerations

Previous economic impact analyses prepared to support critical habitat decisions have considered other types of economic impacts related to CHD, including time delay. This analysis considers these economic impacts and has determined that the proposed critical habitat for CTS will cause economic impacts of this nature. These impacts are described in detail in the section on residential real estate development.

II.5.4 Benefits

Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.[16] OMB's Circular A-4 distinguishes two types of economic benefits: *direct benefits and ancillary benefits*. Ancillary benefits are defined as favorable impacts of a rulemaking that are typically unrelated, or secondary, to the statutory purpose of the rulemaking.[17]

In the context of CHD, the primary purpose of the rulemaking (i.e., the direct benefit) is the potential to enhance conservation of the species. The published economics literature has documented that social welfare benefits can result from the conservation and recovery of endangered and threatened species. In its guidance for implementing Executive Order 12866, OMB acknowledges that it may not be feasible to monetize, or even quantify, the benefits of environmental regulations due to either an absence of defensible, relevant studies or a lack of resources on the implementing agency's part to conduct new research.[18] *Rather than rely on economic measures, the Service believes that the direct benefits of the proposed rule are best expressed in biological terms that can be weighed against the expected cost impacts of the rulemaking.*

Critical habitat designation may also generate ancillary benefits. Critical habitat aids in the conservation of species specifically by protecting the primary constituent elements on which the species depends. To this end, critical habitat designation can result in maintenance of particular environmental conditions that may generate other social benefits aside from the preservation of the species. That is, management actions undertaken to conserve a species or habitat may have coincident, positive social welfare implications, such as increased recreational opportunities in a region. While they are not

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[16] Executive Order 12866, *Regulatory Planning and Review*, September 30, 1993.

[17] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[18] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

the primary purpose of critical habitat, these ancillary benefits may result in gains in employment, output, or income that may offset the direct, negative impacts to a region's economy resulting from actions to conserve a species or its habitat.

It is often difficult to evaluate the ancillary benefits of critical habitat designation. To the extent that the ancillary benefits of the rulemaking may be captured by the market through an identifiable shift in resource allocation, they are factored into the overall economic impact assessment in this report. For example, if decreased off-road vehicle use to improve species habitat leads to an increase in opportunities for wildlife viewing or hiking within the region, the local economy may experience an associated measurable, positive impact. Where data are available, this analysis attempts to capture the *net* economic impact (i.e., the increased regulatory burden less any discernable offsetting market gains), of species conservation efforts imposed on regulated entities and the regional economy.

II.5.5 Time Frame

The analysis estimates impacts based on activities that are "reasonably foreseeable," including, but not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. This analysis estimates economic impacts to activities from 2005 (year of the species' final listing) to 2025 (twenty years from the year of final designation). Forecasts of economic conditions and other factors beyond the next 20 years would be speculative.

II.6 INFORMATION SOURCES

The primary sources of information for this report were communications with and data provided by the Service. In addition, the analysis relies on information from the following entities.

- University of California, Berkeley Department of City and Regional Planning;
- DataQuick Information Systems;
- U.S. Census 1990 and Census 2000;
- U.S. Department of Commerce, Bureau of Economic Analysis;
- U.S. Department of Labor, Bureau of Labor Statistics;
- California Department of Finance;
- California Department of Transportation;
- California Employment Development Department;
- Ebbin, Moser & Skaggs;
- Federal Highway Administration;
- California Department of Conservation Farmland Mapping and Monitoring Program;
- U.S. Bureau of Land Management;

- Nossaman, Guthner, Knox & Elltiot;
- Federal Emergency Management Agency;
- U.S. Geological Survey;
- Marshall & Swift;
- IMPLAN;
- Dun & Bradstreet;
- Robert Morris Associates;
- Environmental Systems Research Institute (ESRI);
- Association of Bay Area Governments (ABAG);
- Association of Monterey Bay Area Governments (AMBAG);
- Council of Fresno County Governments;
- Sacramento Area Council of Governments (SACOG);
- Sycamore Associates;
- San Joaquin Council of Governments (SJCOG);
- Sheppard, Mullin, Richter & Hampton;
- Stanislaus Council of Governments (StanCOG);
- Stoel Rives;
- County Governments.

II.7 Species And Habitat Descriptions

The California tiger salamander is a large and stocky terrestrial salamander with small eyes and a broad, rounded snout.[19] Adults may reach a total length of 208 millimeters (mm) (8.2 inches (in)), with males generally averaging about 203 mm (8 in) in total length, and females averaging about 173 mm (6.8 in) in total length. For both sexes, the average snout-to-vent length is approximately 91 mm (3.6 in). Coloration consists of white or pale yellow spots or bars on a black background on the back and sides. The belly varies from almost uniform white or pale yellow to a variegated pattern of white or pale yellow and black.

The CTS inhabits, in Central California, low-elevation (typically below 1,500 feet (ft) (460 m)), vernal pools, vernal pool complexes, and seasonal ponds in associated annual grasslands, oak savannah, and coastal scrub plant communities of the Bay Area (Santa Clara Valley), Central Coast, Central Valley, and Southern San Joaquin Valley. The CTS spends most of its lifetime in upland habitats, within the underground burrows of small mammals, especially those of California ground squirrels (*Spermophilus beecheyi*) and

[19] Specie and habitat descriptions summarized from the listing and proposed ruling, published in the Federal Register on August 4, 2004 (69 FR 47212) and August 10, 2004, respectively (69 FR 48570).

valley pocket gophers (*Thomomys bottae*). These burrows provide food for California tiger salamanders, as well as protection from the sun and wind associated with the dry California climate that can cause desiccation of amphibian skin.

During its breeding phase, the CTS requires aquatic habitats that remain inundated for a minimum of 12 weeks to allow for successful metamorphosis. In some areas, stock ponds have largely replaced vernal pools as breeding pools (due to the loss of vernal pools) and provide important habitat for the species. The larvae feed on zooplankton, small crustaceans, and aquatic insects for about six weeks after hatching, after which they switch to larger prey. The longer the inundation period, the larger the larvae and metamorphosed juveniles are able to grow, and the more likely they are to survive and reproduce. The larvae perish if a site dries before they complete metamorphosis. Lifetime reproductive success for California and other tiger salamanders is low. Previous research has found that the average female breeds 1.4 times and produces 8.5 young that survived to metamorphosis per reproductive effort. This resulted in roughly 11 metamorphic offspring over the lifetime of a female. Juveniles do not typically return to the breeding pools until they reach sexual maturity at two years of age at a minimum and survival to adulthood may be low. Tiger salamanders do not always return to the same breeding pond every year. Documented dispersers have moved up to 2,200 ft (670 m), and, based on a projected exponential relationship between dispersal probability and distance, less than 1 percent of dispersers are likely to move between ponds separated by 0.70 mile (mi) (1,160 m).

II.7.1 Primary Constituent Elements

In identifying areas as critical habitat for the CTS, the Service considered those physical and biological habitat features that are essential to the conservation of the species. These essential features are referred to as the species' primary constituent elements (PCEs). Areas which do not contain any PCEs at the time of critical habitat designation are not considered critical habitat, whether or not they occur within a mapped critical habitat unit.

Because of limitations in Geographic Information Systems data, the Service did not exclude all developed areas, such as towns, housing developments, or other lands unlikely to contain the PCEs essential for the conservation of vernal pool species. In addition, the fragmented and isolated nature of remaining vernal pool habitats prevent an easy grouping of the habitats into cohesive units without including some areas that do not contain the PCEs. Existing features and structures within the boundaries of the mapped units, such as buildings, roads, most intensively farmed areas, etc., are unlikely to contain one or more of the PCEs, and are therefore not considered critical habitat. As a result, Federal actions in those areas would not trigger section 7 consultations unless the actions affect the species or PCEs in adjacent critical habitat.

Critical habitat for the Central population includes essential aquatic habitat, essential upland nonbreeding habitat with underground refugia, dispersal habitat connecting occupied California tiger salamander locations to each other, and vernal pool complexes where integrated function of uplands and wetlands provide physical and biological features essential to the conservation of the species. The Service determined the following three PCEs for the CTS:

(1) Standing bodies of fresh water (including natural and manmade (e.g., stock) ponds, vernal pools, and other ephemeral or permanent water bodies) along with their associated geographic, topographic, and edaphic features that support the hydrological functioning of the water body that typically become inundated during winter rains. These hydrologic features contribute to the filling and drying of the water body and maintain suitable periods of inundation, water quality, and soil moisture for the species to complete the aquatic portion of its life cycle.

(2) Upland habitats adjacent to breeding ponds that contain small mammal burrows, including but not limited to burrows created by the Botta's pocket gopher. Small mammals are essential in creating the underground habitat that California tiger salamanders depend upon for food, shelter, and protection from the elements and predation.

(3) Barrier-free upland dispersal habitat between occupied locations and areas with small mammal burrows that allow for movement between such sites.

Vernal pool complexes addressed in the first PCE provide a significant amount of the habitat for Central population remaining in the southern San Joaquin and Central Valley regions, but less so in the Bay Area and Coast Range regions because so much vernal pool habitat has been converted to other land uses. Vernal pools and other natural seasonal ponds are the primary historic breeding sites used by California tiger salamanders.

II.8 PROPOSED CRITICAL HABITAT AND AFFECTED COUNTIES

The Service has designated approximately 382,669 acres across 20 counties: Alameda, Amador, Calaveras, Contra Costa, Fresno, Kern, Kings, Madera, Mariposa, Merced, Monterey, Sacramento, San Benito, San Joaquin, San Luis Obispo, Santa Clara, Solano, Stanislaus, Tulare, and Yolo. Federal and State land account for approximately 39,032 and 17,262 acres, respectively, with private land composing the remaining 326,375 acres. For this analysis, the proposed area was divided into five regions: Sacramento Valley, Central Valley, Southern San Joaquin Valley, San Francisco Bay Area, and Central Coast.[20] Additional descriptions of the regions, including the number of designated acres and land-ownership patterns can be found below and are summarized in Table II-1: Summary of Critical Habitat Units by County and Region. For background information about the socioeconomic conditions in the affected counties, please see Section II.

II.8.1 Units in the Sacramento Valley Region

Comprised of Amador, Calaveras, Sacramento, and Yolo counties, this region contains 20,906 acres of proposed habitat. Sacramento County holds almost half of the proposed

[20] The proposed ruling divides Alameda, Madera, Merced, and San Benito counties across various regions. For simplicity in calculating and reporting the economic effects of designation, all proposed habitat in Alameda County is included in the San Francisco Bay Region. Similarly, Merced County is contained in the Central Valley Region, Madera County is incorporated into the Southern San Joaquin Valley Region, and San Benito County is assigned to the Central Coast Region. In addition, the regions used in this analysis vary from those defined in the proposed ruling in order to more closely mirror the distinctions made by Association of Governments and regional planners.

acres (10,360), while Amador maintains the least amount (1,514). All of the habitat units exist on privately owned land.

II.8.2 Units in the Central Valley Region

This region is composed of 95,119 acres spanning across Mariposa, Merced, San Joaquin, and Stanislaus counties. The majority of the proposed habitat occurs in Merced County (49,406 acres), while Mariposa County contains the smallest share (385 acres). Of the 13 proposed habitat units, nine occur on privately owned land while the remaining four exist in a mix of private and government land.

II.8.3 Units in the Southern San Joaquin Valley Region

Fresno, Kern, Kings, Madera, and Tulare counties comprise the Region, which contains 42,420 acres of proposed habitat. Fresno and Madera counties combined share the bulk of the proposed acres (33,786 acres). The nine critical habitat units within the region exist on a mix of public and privately owned land.

II.8.4 Units in the San Francisco Bay Area Region

This Region contains land in Alameda, Contra Costa, Santa Clara, and Solano counties. Of the 159,471 proposed acres, the majority fall in Alameda County (67,673 acres). Of the 20 critical habitat units, 10 occur on privately owned land and the remainder exist on a mix of private and government land.

II.8.5 Units in the Central Coast Region

Comprised of Monterey, San Benito, and San Luis Obispo counties, this Region includes 64,751 acres of proposed habitat. Monterey County incorporates 32,388 acres, while San Benito and San Luis Obispo counties contain 24,635 and 7,728 acres, respectively. A total of ten units are distributed amongst the three counties. The proposed area is managed by both government and private landowners.

II.9 Report Outline

The next section provides an overview of the baseline economic conditions in the 20 affected California counties, including a description of past and projected employment conditions, housing growth, and population changes. Subsequent sections will quantify the economic effects on the land development markets, as well as identify the effects at regional levels. The impacts on public projects and activities can be found in Section VIII, followed by an analysis of the economic impacts to small businesses.

Table II-1: Summary of Critical Habitat Units by County and Region

Region	County	Total Number of Proposed Habitat Units in County	Total Acres of Proposed Habitat	Totals Acres in County
Sacramento Valley				
	Amador	1	1,514	387,428
	Calaveras	2	5,243	663,008
	Sacramento	1	10,360	635,854
	Yolo	1	3,789	653,897
Subtotal		5	20,906	2,340,187
Central Valley				
	Mariposa	1	385	934,971
	Merced	7	49,406	1,261,121
	San Joaquin	2	20,872	911,726
	Stanislaus	3	24,456	969,630
Subtotal		13	95,119	4,077,448
Southern San Joaquin Valley				
	Fresno	2	16,388	3,851,267
	Kern	1	1,504	5,223,345
	Kings	1	890	890,657
	Madera	2	17,398	1,378,184
	Tulare	3	6,240	3,098,359
Subtotal		9	42,420	14,441,813
San Francisco Bay Area				
	Alameda	6	67,673	524,750
	Contra Costa	5	43,182	514,952
	Santa Clara	8	42,673	835,905
	Solano	1	5,944	582,146
Subtotal		20	159,471	2,457,752
Central Coast				
	Monterey	5	32,388	2,120,220
	San Benito	4	24,635	889,415
	San Luis Obispo	1	7,728	2,124,831
Subtotal		10	64,751	5,134,467
Total		47	382,669	28,451,667

Source: FWS data files.

III SOCIOECONOMIC PROFILE OF AFFECTED COUNTIES

To understand the economic impacts of critical habitat designation for the CTS, it is essential to have an accurate picture of current and projected economic activity. This section presents a summary of the current conditions and forecasts for the affected counties by examining population growth, employment sectors, and housing trends.

Assuming the present growth trends continue, the population in California will likely total 40 million in 2010 and 45.5 million in 2020.[21] The California Department of Finance estimates a growth rate of 1.3 percent per year from 2010 to 2020 and a total change of 29 percent between 2000 and 2020. It's predicted that the population increase will strain the urban housing markets. An estimated 220,000 additional housing units will have to be constructed every year through 2020 in order to keep pace with the expanding population. For comparison, an average of 100,000 permits were issued for new home construction in the state each year between 1990 and 2000. Single-family home construction has been the trend; between 1987 and 2001, this type of development represented 80 percent of new home construction.[22]

The following sections review the growth patterns in the regions and counties that contain proposed critical habitats. In addition, economic activity is characterized by the current and future employment sectors. Table III-1: Demographic Profile of Affected Counties presents the changes in population, jobs, and housing units that occurred between 1990 and 2000 and the change in the unemployment rates between 2000 and 2004. Table III-2: Population Changes in Affected Counties, 2000-2020 displays the predicted changes in population between 2000 and 2020, as estimated by the Demographic Research Unit of the California Department of Finance.[23] Table III-3 summarizes the business and employment patterns for the 35 counties with critical habitat units, and Table III-4: Jobs to Housing Ratios displays the jobs-to-housing ratios in the counties as of the 1990 Census and 2000 Census.

III.1 UNITS IN THE SACRAMENTO VALLEY REGION

The Central Valley Region, composed of Amador, Calaveras, Sacramento, and Yolo counties, grew by 223,465 residents, or 18 percent, between 1990 and 2000. The Region also added 71,841 new housing units and 143,518 jobs over the same ten-year period. Between 2000 and 2020, the county populations are expected to grow by 6,823 (19 percent) in Amador, 18,801 (46 percent) in Calaveras, 716,214 (58 percent) in Sacramento, and 101,158 (59 percent) in Yolo.

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[21] Raising the Roof, California's Housing Development Projections and Constraints, 1997-2020, California Department of Housing and Community Development, May 2000, http://www.hcd.ca.gov/hpd/hrc/rtr/index.html

[22] Raising the Roof, California's Housing Development Projections and Constraints, 1997-2020, California Department of Housing and Community Development, May 2000, http://www.hcd.ca.gov/hpd/hrc/rtr/index.html

[23] State of California, Department of Finance, Population Projections by Race/Ethnicity, Gender and Age for California and Its Counties 2000-2050, Sacramento, California, May 2004, http://www.dof.ca.gov/html/demograp/DRU_Publications/Projections/P3/P3.htm

As of 2002, the following principal industries, in terms of annual payroll, existed in the region: retail trade, health care and social assistance; manufacturing; and, construction.[24] In addition, the finance and insurance industries maintained large payrolls in Sacramento County and wholesale trade was an important industry for Yolo County. The largest industries, ranked by number of employees in 2002, include trade, government, professional, and hospitality services. The region is expected to add additional jobs in the services, public, retail, manufacturing, healthcare, and technology sectors.[25]

The median new home prices in 2004 were $337,480 (Amador), $375,093 (Calaveras), and $412,717 (Sacramento).[26] As of the 2000 Census, the region held a 1.5 jobs-to-housing ratio, with a range of 0.7 (Calaveras) to 1.8 (Yolo).

III.2 Units In The Central Valley Region

Between 1990 and 2000, the Central Valley Region, which includes Mariposa, Merced, San Joaquin, and Stanislaus counties, experienced 18 and 14 percent increases in population and housing, respectively. An additional 88,008 jobs were added over the same time period. Between 2000 and 2020, the county populations are predicted to increase by 3,422 (20 percent) in Mariposa, 149,955 (71 percent) in Merced, 421,664 (74 percent) in San Joaquin, and 204,064 (45 percent) in Stanislaus.[27] In total, the four counties are predicted to grow by 779,105 residents between 2000 and 2020.

As of 2002, the following principal industries, in terms of annual payroll, existed in the region: retail trade, health care and social assistance; manufacturing; and, accommodation and food services.[28] The largest industries, ranked by number of employees in 2002, include trade, manufacturing, government, hospitality services, and agriculture. The region is expected to add additional jobs in the services, manufacturing, government, and retail sectors. Additionally, the counties will continue to see growth in the agricultural and tourism industries.[29]

The median new home prices in 2004 were $301,915 (Merced), $400,000 (San Joaquin), and $357,742 (Stanislaus).[30] As of the 2000 Census, the region held a 1.3 jobs-to-housing ratio, with a range of 0.9 (Mariposa) to 1.4 (San Joaquin and Stanislaus).

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[24] U.S. Census Bureau, 2002 County Business Patterns, http://censtats.census.gov/cbpnaic/cbpnaic.shtml

[25] Long-Term Socioeconomic Forecasts by County 2003-2020, California Department of Transportation, Office of Transportation Economics, May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm

[26] DataQuick Information Systems, Assessor Database, www.dataquick.com

[27] State of California, Department of Finance, Population Projections by Race / Ethnicity for California and Its Counties 2000-2050, Sacramento, California, May 2004, http://www.dof.ca.gov/html/demograp/DRU_Publications/Projections/P1.htm

[28] U.S. Census Bureau, 2002 County Business Patterns, http://censtats.census.gov/cbpnaic/cbpnaic.shtml

[29] Long-Term Socioeconomic Forecasts by County 2003-2020, California Department of Transportation, Office of Transportation Economics, May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm

[30] DataQuick Information Systems, Assessor Database, www.dataquick.com

III.3 Units In The Southern San Joaquin Valley Region

This region includes Fresno, Kern, Kings, Madera, and Tulare counties and experienced a 21 percent increase in population between 1990 and 2000. The region also added 98,034 housing units (16 percent increase) and 187,542 jobs. Madera County posted the greatest increases in population (39 percent) and housing units (31 percent) over the ten-year period. Between 2000 and 2020, the region is expected to add 885,587 residents.[31]

The following industries in the region ranked high in terms of annual payroll in 2002: health care and social assistance, manufacturing, retail trade, and construction.[32] The agriculture, retail, government, and education sectors employed the majority of the residents in the region in 2002. Growth in the region is predicted to continue, with additional jobs in agriculture, retail, government, healthcare, construction, and manufacturing industries.[33]

The median new home prices in 2004 were $290,336 (Fresno), $234,901 (Kern), $321,813 (Kings), $255,225 (Madera), and $169,910 (Tulare).[34] As of the 2000 Census, the region held a 1.4 jobs-to-housing ratio, with a range of 1.3 (Madera) to 1.5 (Fresno and Tulare). Within the state, this region is predicted to see the largest percentage household growth between 1997 and 2020, as estimated by the California Department of Finance.[35]

III.4 Units In The San Francisco Bay Area Region

Alameda, Contra Costa, Santa Clara, and Solano counties comprise the San Francisco Bay Area Region, which experienced a 14 percent increase in population between 1990 and 2000. The region also added 128,550 housing units (8 percent increase) and 478,751 jobs. Between 2002 and 2020, the region is expected to add 1,259,902 residents.[36] Growth in this region is of particular concern, given the already strained transportation network.[37]

As of 2002, the following industries posted the highest annual payrolls in the region: manufacturing; professional, scientific and technical services; health care and social

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[31] State of California, Department of Finance, Population Projections by Race / Ethnicity for California and Its Counties 2000-2050, Sacramento, California, May 2004, http://www.dof.ca.gov/html/demograp/DRU_Publications/Projections/P1.htm

[32] U.S. Census Bureau, 2002 County Business Patterns, http://censtats.census.gov/cbpnaic/cbpnaic.shtml

[33] Long-Term Socio Economic Forecasts by County 2003-2020, California Department of Transportation, Office of Transportation Economics, May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm

[34] DataQuick Information Systems, Assessor Database, www.dataquick.com.

[35] Raising the Roof, California's Housing Development Projections and Constraints, 1997-2020, California Department of Housing and Community Development, May 2000, http://www.hcd.ca.gov/hpd/hrc/rtr/index.html.

[36] State of California, Department of Finance, Population Projections by Race / Ethnicity for California and Its Counties 2000-2050, Sacramento, California, May 2004, http://www.dof.ca.gov/html/demograp/DRU_Publications/Projections/P1.htm.

[37] ABAG Regional Housing Need Determination, Chapter 2, 2001-2006, October 2002.

assistance; finance and insurance; wholesale trade; and, construction.[38] The largest industries, ranked by number of employees in 2002, include trade, education, government, and professional services. Additional jobs in the services, healthcare, government, and education sectors are predicted.[39]

The median new home prices in 2004 were $818,692 (Alameda), $549,401 (Contra Costa), $792,886 (Santa Clara), and $516,387 (Solano).[40] As of the 2000 Census, the region held a 1.8 jobs-to-housing ratio, with a range of 1.2 (Solano) to 2.2 (Santa Clara).

III.5 Units In The Central Coast Region

Composed of Monterey, San Benito, and San Luis Obispo counties, the Central Coast Region experienced a 7 percent change in population from 1990-2000. An additional 16,344 housing units and 40,451 jobs were added, driven by growth in San Benito County. The Region is predicted to add 178,447 residents between 2000 and 2020.[41]

As of 2002, the following principal industries, in terms of annual payroll, existed in the region: health care and social assistance; retail and wholesale trade; manufacturing; and, construction.[42] Agriculture, trade, government, and leisure and hospitality sectors employed the most residents in 2002. Growth in the region is predicted to continue, with additional jobs in the education, healthcare, and public sectors.[43]

The median new home prices in 2004 were $422,848 (Monterey) and $456,134 (San Luis Obispo).[44] As of the 2000 Census, the region held a 1.5 jobs-to-housing ratio, with a range of 1.3 (San Benito) to 1.7 (Monterey).

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[38] U.S. Census Bureau, 2002 County Business Patterns, http://censtats.census.gov/cbpnaic/cbpnaic.shtml

[39] Long-Term Socio Economic Forecasts by County 2003-2020, California Department of Transportation, Office of Transportation Economics, May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm

[40] DataQuick Information Systems, Assessor Database, www.dataquick.com.

[41] State of California, Department of Finance, Population Projections by Race / Ethnicity for California and Its Counties 2000-2050, Sacramento, California, May 2004, http://www.dof.ca.gov/html/demograp/DRU_Publications/Projections/P1.htm

[42] U.S. Census Bureau, 2002 County Business Patterns, http://censtats.census.gov/cbpnaic/cbpnaic.shtml

[43] Long-Term Socio Economic Forecasts by County 2003-2020, California Department of Transportation, Office of Transportation Economics, May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm

[44] DataQuick Information Systems, Assessor Database, www.dataquick.com.

Table III-1: Demographic Profile of Affected Counties

Region[45]	County	Change in Population, 1990-2000 (1)	Percent Change in Population, 1990-2000 (2)	Change in Housing Units, 1990-2000 (3)	Percent Change in Housing Units, 1990-2000 (4)	Change in Number of Jobs, 1990-2000 (5)	Change in Unemployment Rate, 2004-2000 (6)
Sacramento Valley							
	Amador	5,061	16.8	2,221	17.3	4,096	0.4
	Calaveras	8,556	26.7	3,793	19.8	3,702	0.6
	Sacramento	182,280	17.5	57,240	13.7	107,996	1.3
	Yolo	27,568	19.5	8,587	16.2	27,724	0.8
	Region	223,465	18.0	71,841	14.3	143,518	
Central Valley							
	Mariposa	2,828	19.8	1,126	14.6	222	-0.5
	Merced	32,151	18.0	9,963	17.1	7,322	-0.3
	San Joaquin	82,970	17.3	22,886	13.8	43,729	1.1
	Stanislaus	76,475	20.6	18,780	14.2	36,735	0.8
	Region	194,424	18.6	52,755	14.5	88,008	
Southern San Joaquin Valley							
	Fresno	131,917	19.8	35,204	14.9	65,882	-1.3
	Kern	118,168	21.7	32,928	16.6	59,663	1.1
	Kings	27,992	27.6	5,720	18.5	10,267	-0.5
	Madera	35,019	39.8	9,556	31.0	17,990	0.0
	Tulare	56,100	18.0	14,626	13.9	33,740	-0.4

[45] For additional information about the selection of regions, please see the Relevant Background and Analytical Framework section of the report.

Region[45]	County	Change in Population, 1990-2000 (1)	Percent Change in Population, 1990-2000 (2)	Change in Housing Units, 1990-2000 (3)	Percent Change in Housing Units, 1990-2000 (4)	Change in Number of Jobs, 1990-2000 (5)	Change in Unemployment Rate, 2004-2000 (6)
	Region	369,196	21.6	98,034	16.3	187,542	
San Francisco Bay Area							
	Alameda	164,559	12.9	36,074	7.2	140,605	2.9
	Contra Costa	145,084	18.1	38,407	12.1	77,486	1.2
	Santa Clara	185,008	12.4	39,089	7.2	237,999	4.1
	Solano	54,121	15.9	14,980	12.5	22,661	1.5
	Region	548,772	14.0	128,550	8.7	478,751	
Central Coast							
	Monterey	46,102	13.0	10,484	8.6	20,196	0.3
	San Benito	16,537	45.1	4,269	34.9	5,986	1.1
	San Luis Obispo	29,519	13.6	12,075	13.4	34,465	0.4
	Region	46,056	7.6	16,344	7.3	40,451	
State		4,111,627	14	1,031,667	9.2	2,660,826	1.2

Sources:

(1) "Census 2000 PHC-T-4. Ranking Tables for Counties: 1990 and 2000", released 2 April 2001, U.S. Census Bureau, Census 2000 Redistricting Data (P.L. 94-171) Summary File and 1990 Census, http://www.census.gov/population/www/cen2000/phc-t4.html

(2) U.S. Census 1990 Summary File 3, Table H1: Housing Units and U.S. Census 2000 Summary File 3, Table H1: Housing Units, http://factfinder.census.gov

(3) U.S. Bureau Economic Analysis, Regional Economic Information System, Table CA30, May 2004, http://www.bea.doc.gov/bea/regional/reis/

(4) U.S. Bureau of Labor Statistics, Unemployment Rates by County in 2000 and 2005, Not Seasonally Adjusted, http://data.bls.gov/map/servlet/map.servlet.MapToolServlet?survey=la

Table III-2: Population Changes in Affected Counties, 2000-2020

County	Population Change	Percent Change
Alameda	413,036	28.5
Amador	6,823	19.3
Calaveras	18,801	46.0
Contra Costa	372,577	39.0
Fresno	311,253	38.7
Kern	285,418	42.9
Kings	54,928	42.3
Madera	59,594	47.9
Mariposa	3,422	19.9
Merced	149,955	71.1
Monterey	101,723	25.2
Sacramento	716,214	58.2
San Benito	19,777	36.8
San Joaquin	421,664	74.3
San Luis Obispo	56,947	22.9
Santa Clara	315,809	18.7
Solano	158,480	39.9
Stanislaus	204,064	45.4
Tulare	174,394	47.2
Yolo	101,158	59.5
Total	9,808,543	28.8

Source: State of California, Department of Finance, Population Projections by Race/Ethnicity for California and Its Counties 2000–2050, Sacramento, California, May 2004, available for download http://www.dof.ca.gov/html/demograp/DRU_Publications/Projections/P1.htm

Table III-3: Employment by Industry, 2002

Region[46]	County	Top Three Industries[47]	Number of Employees	Percent of Total Employees in County
Sacramento Valley				
	Amador	Government	4,690	37.6
		Trade, Transportation, and Utilities	2,010	16.1
		Professional and Business Services	1,220	9.8
	Calaveras	Government	2,580	29.2
		Trade, Transportation, and Utilities	1,480	16.7
		Leisure and Hospitality	1,150	13.0
	Sacramento[48]	Government	195,800	26.2
		Trade, Transportation, and Utilities	120,700	16.2
		Professional and Business Services	88,700	11.9
	Yolo	Government	31,600	34.3
		Trade, Transportation, and Utilities	20,400	22.1
		Professional and Business Services	7,900	8.6
Central Valley				
	Mariposa	Leisure and Hospitality	1,970	35.1
		Government	1,880	33.5
		Professional and Business Services	640	11.4
	Merced	Government	13,500	20.5
		Trade, Transportation, and Utilities	11,000	16.7
		Agriculture	10,900	16.5
		Manufacturing	10,900	16.5
	San Joaquin	Trade, Transportation, and Utilities	44,300	21.1
		Government	40,100	19.1

[46] For additional information about the selection of regions, please see the Relevant Background and Analytical Framework section of the report.

[47] Ranked by number of employees in 2002.

[48] Sacramento Metropolitan Statistical Area.

Region[46]	County	Top Three Industries[47]	Number of Employees	Percent of Total Employees in County
		Educational and Health Services	23,300	11.1
	Stanislaus	Trade, Transportation, and Utilities	31,700	19.2
		Government	25,300	15.3
		Manufacturing	22,500	13.6
Southern San Joaquin Valley				
	Fresno / Madera[49]	Trade, Transportation, and Utilities	58,800	16.0
		Agriculture	55,700	15.2
		Educational and Health Services	38,700	10.6
	Kern	Government	55,200	22.6
		Agriculture	40,200	16.4
		Trade, Transportation, and Utilities	38,900	15.9
	Kings	Government	13,400	34.6
		Agriculture	7,000	18.1
		Trade, Transportation, and Utilities	4,600	11.9
	Tulare	Agriculture	33,700	24.7
		Government	29,600	21.7
		Trade, Transportation, and Utilities	21,900	16.1
San Francisco Bay Area				
	Alameda[50]	Trade, Transportation, and Utilities	203,900	19.5
		Government	185,500	17.7
		Professional and Business Services	151,200	14.5
	Contra Costa[51]	Trade, Transportation, and Utilities	203,900	19.5
		Government	185,500	17.7
		Professional and Business Services	151,200	14.5
	Santa Clara	Manufacturing	203,600	22.3

[49] Fresno Metropolitan Statistical Area (includes Madera County.)

[50] Oakland Metropolitan Statistical Area.

[51] Oakland Metropolitan Statistical Area.

Region[46]	County	Top Three Industries[47]	Number of Employees	Percent of Total Employees in County
		Professional and Business Services	172,500	18.9
		Trade, Transportation, and Utilities	134,600	14.7
	Solano[52]	Government	36,300	19.2
		Trade, Transportation, and Utilities	33,100	17.5
		Educational and Health Services	23,000	12.2
Central Coast				
	Monterey	Agriculture	35,400	21.2
		Government	31,300	18.7
		Trade, Transportation, and Utilities	25,600	15.3
	San Benito	Government	3,000	19.9
		Trade, Transportation, and Utilities	2,610	17.3
		Agriculture	2,420	16.0
	San Luis Obispo	Government	23,100	22.2
		Trade, Transportation, and Utilities	19,000	18.3
		Leisure and Hospitality	13,700	13.2

Source: California Employment Development Department, Labor Market Information Division, 2002 County Snapshots, http://www.calmis.ca.gov/htmlfile/subject/COsnaps.htm

[52] Vallejo - Fairfield - Napa Metropolian Statistical Area.

Table III-4: Jobs to Housing Ratios

Region[53]	County	1990	2000
Sacramento Valley			
	Amador	1.0	1.1
	Calaveras	0.6	0.7
	Sacramento	1.5	1.5
	Yolo	1.5	1.8
	Region	1.4	1.5
Central Valley			
	Mariposa	1.0	0.9
	Merced	1.3	1.2
	San Joaquin	1.3	1.4
	Stanislaus	1.3	1.4
	Region	1.3	1.3
Southern San Joaquin Valley			
	Fresno	1.5	1.5
	Kern	1.3	1.4
	Kings	1.3	1.4
	Madera	1.2	1.3
	Tulare	1.4	1.5
	Region	1.4	1.4
San Francisco Bay Area			
	Alameda	1.5	1.7
	Contra Costa	1.3	1.3
	Santa Clara	1.9	2.2
	Solano	1.2	1.2
	Region	1.6	1.8
Central Coast			
	Monterey	1.7	1.7
	San Benito	1.3	1.3
	San Luis Obispo	1.2	1.4
	Region	1.5	1.5
State		1.5	1.6

Sources:

(1) U.S. Census 1990 Summary File 3, Table H1: Housing Units, http://factfinder.census.gov

[53] For additional information about the selection of regions, please see the Relevant Background and Analytical Framework section of the report.

(2) U.S. Census 2000 Summary File 3, Table H1: Housing Units, http://factfinder.census.gov

(3) U.S. Bureau Economic Analysis, Regional Economic Information System, Table CA30, May 2004, http://www.bea.doc.gov/bea/regional/reis

IV ECONOMIC IMPACTS ON LAND DEVELOPMENT

A primary aim of this analysis is to estimate the economic impacts of designation on the markets for land, housing and commercial real estate. The methodology used to estimate these impacts is described below, followed by a discussion of the calculated results. The section concludes with an estimate of the total costs of critical habitat designation attributable to regulation of land development.

IV.1 BACKGROUND

This portion of the analysis considers the effects of designation on the linked markets for land and improvements to land such as housing and commercial buildings. At the guidance of the OMB and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to understand how society, as a whole, will be affected by a regulatory action.[54] In the context of this regulatory action, these efficiency effects represent the overall welfare gained or lost by society as a result of critical habitat designation. Economists generally characterize welfare in terms of changes in producer and consumer surpluses in affected markets.[55]

IV.1.1 Compliance with Section 7 of the Act

The measurement of direct compliance costs focuses on the implementation of Section 7 of the Act. This section requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. The costs of project modifications and mitigation requirements resulting from these consultations represent the direct compliance costs of designating critical habitat.

The estimate of total Section 7 impacts presented in this analysis does not differentiate between consultations that result from the listing of the species (i.e., the jeopardy standard) and consultations that result from the presence of critical habitat (i.e., the adverse modification standard). Consultations resulting from the listing of the species, or project modifications meant specifically to protect the species, as opposed to its habitat, may occur even in the absence of critical habitat. However, in 2001, the 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic

[54] Executive Order 12866, "Regulatory Planning and Review," September 30, 1993; Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," May 18, 2001; 5 U.S.C. §§ 601 *et seq*; and Pub Law No. 104–121; and 2 U.S.C. §§658–658g and 1501–1571.

[55] For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see Gramlich, Edward M., *A Guide to Benefit-Cost Analysis (2nd Ed.)*, Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. Environmental Protection Agency, *Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/ webpages/Guidelines.html.

impacts of critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes.[56]

IV.1.2 Defining Co-Extensive Effects

This report complies with direction from the U.S. 10th Circuit Court of Appeals that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[57] Estimates of the regulatory impacts are derived from the Service's consultation history (see Section IV.2.4.) When assigning mitigation responsibilities, the Service frequently considers additional regulations beyond the ESA (such as the CWA and/or CEQA.) Hence, the impacts presented in this report include the regulatory burden of both ESA-related conservation and other pre-existing environmental legislation.

IV.1.3 Time Frame

The analysis examines activities taking place both within and adjacent to the proposed designation. It estimates impacts based on activities that are "reasonably foreseeable," including, but not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. Accordingly, the analysis bases estimates on activities that are likely to occur within a 20-year time frame, beginning on the day that the current proposed rule becomes available to the public.

Twenty years is an optimal time frame for this analysis for several reasons. First, the scale of the proposed critical habitat designation requires the use of regional and county level growth data. In the State of California, this data is readily available beyond the ten year horizon. A 20-year time frame is very common among a number of planning and development tools including: California State-mandated jurisdictional General Plans, population and employment projections by regional associations of governments, and project planning and the calculation of absorption rates and financial rates of return by real estate developers. If the proposed critical habitat designation had been restricted to a handful of local, single-county sites, this data would not have been useful and a shorter interval period, perhaps 10 years, would have been more appropriate.

In addition, speculative real estate transactions in high growth communities in the Central Valley frequently involve land not yet annexed into cities and land upon which development is not likely to occur for 15 to 20 years. Master planned communities consisting of hundreds, if not thousands, of acres of raw land increasingly require more than ten years to receive planning approvals from local, State and Federal agencies. Certain land development interests that precede the ownership by the eventual land developer, therefore, often financially control property more than a decade in advance of the first project application. Farming or ranching may continue, but critical habitat

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[56] *New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001).

[57] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001)).

designation has the potential to affect development potential and associated speculative land value at a very early stage in the development process.

IV.2 METHODOLOGY

The total economic impact of critical habitat designation depends on a variety of factors, including the size of the designation, the nature of pre-existing markets and regulation, and geographical features of the designated land itself. Because these factors vary by region, the methodology adopts the Census tract as its baseline unit of analysis. This modeling choice invests the results with a high degree of spatial precision.

Economic repercussions of the designation affect landowners, builders and housing consumers in different ways. Accordingly, the methodology analyzes both costs of designation and their incidence on producers and consumers.

The steps followed to determine the impacts of critical habitat designation on housing markets are:

- Describe current and projected economic and demographic characteristics in the proposed critical habitat areas;
- Determine the effects and significance of prior regulation of land development in affected areas;
- Determine the intersection of future development and critical habitat determination;
- Determine the incremental, project-level regulatory requirements resulting from critical habitat designation;
- Calculate the market effects of critical habitat and estimate economic costs for these areas.

Each step is discussed in greater detail below.

IV.2.1 Socioeconomic Characteristics Critical Habitat Areas

Data on current and future socioeconomic characteristics for areas affected by critical habitat designation are necessary precursors to this analysis. To obtain present-day estimates, data were obtained from several sources, including population and household data the most recent United States Census, and data on new home characteristics from DataQuick, a housing market research firm. These are used to establish the economic baseline against which the market impacts of the critical habitat designation are measured.

The analysis also requires forecasted data to investigate impacts at the end of the 20-year time frame (see Section for further information on the time frame.) Population forecasts were derived from several sources, including federally-recognized metropolitan planning organizations and forecasting performed in prior studies for transportation planning purposes. County-level forecasts on gross urban density—including residential, commercial and public development—along with shares of greenfield and infill development were obtained from a study performed by urban planning researchers at the

University of California.[58,59] Combining density and population forecasts yields an estimate of the overall urban footprint within each Census tract.

Table IV-1: Socioeconomic Characteristics of Affected Tracts summarizes some of this baseline information. Each FIPS code corresponds to a distinct Census tract within a county. Median home prices are in 2005 dollars and are for newly constructed single-family residences. Average square footage is indicative of the size of these homes. The projected population increase indicates the Census tracts projected to experience the most rapid development. Since these are net population increases, they are used to specify the demand for new housing in each census tract. The last column shows the number of new dwellings needed to accommodate the projected population increase in each Census tract.

IV.2.2 Prior Regulation in Affected Areas

Markets for land, housing and commercial real estate are highly regulated by governments at the local, State and Federal level. The welfare impacts of critical habitat designation are affected by the nature and extent of prior regulation, and by the response of governments at all levels to the designation of critical habitat.

Regulation can have several types of effects on land and housing markets. Zoning and other interventions in the land market can limit the stock of developable land and increase its price. Local regulations can also directly limit the construction of new housing. This latter type of intervention is important as it generates qualitatively different predictions about the effects of critical habitat than regulations that simply limit the amount of developable land.

As explained in an Appendix to the report, when the number of housing units constructed is directly limited by regulation, there is a "shadow value" of housing that is not necessarily incorporated in the price of land. These rents are earned by providers of fixed factors to the homebuilding process. When critical habitat designations impose further restrictions on an already constrained homebuilding process, welfare impacts can be larger than if the number of housing units constructed is not directly controlled by regulation.

As noted in the recent academic literature, there are ways to test whether housing is rationed by prior regulation.[60] These tests amount to comparing the "extensive" and "intensive margin" values of land. These terms are loosely defined as the value of land with a house on it and the marginal willingness of consumers to pay for an additional unit of lot size. In the conventional case where regulation may limit the supply of land but not

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[58] John D. Landis and Michael Reilly, "How We Will Grow: Baseline Projections of the Growth of California's Urban Footprint through the Year 2100" (August 1, 2003). Institute of Urban & Regional Development. IURD Working Paper Series. Paper WP-2003-04. http://repositories.cdlib.org/iurd/wps/WP-2003-04

[59] Greenfield development refers to development occurring on land that was not previously urbanized. Infill development refers to the redeveloping of already-urbanized land—for example, leveling an old home and building a new apartment complex over it.

[60] David Sunding and Aaron Swoboda, *Does Regulation Ration Housing?*, UC Berkeley Working Paper, 2004, and Ed Glaeser and Joseph Gyourko, *The Impacts of Building Restrictions on Housing Affordability*, Federal Reserve Boards of New York Economic Policy Review, 2003.

the number of housing units built, extensive and intensive margin values should be the same since density will adjust to equate the two. When housing is directly limited by regulation, the extensive margin value will exceed the intensive margin value. The rationale is that the extensive margin value incorporates the shadow value of housing while the intensive margin value is simply the value of additional lot size.

This test was implemented using our data on new home sales and house characteristics described earlier. After deleting observations where relevant home characteristics were missing, roughly 33,000 observations remained. A hedonic regression was estimated to gauge the contributions of various housing characteristics to the sales price of new housing. The extensive margin value of land was calculated by subtracting building costs from home price and dividing by lot size. At conventional levels of significance, the extensive margin value of land exceeds the intensive margin value in our sample, and we are unable to rule out the possibility that housing in the study area is rationed by regulation unrelated to critical habitat.

One implication of this finding is that the ultimate impacts of critical habitat may depend in an important way on how local governments respond to the designation. If housing restrictions are relaxed in response to the designation of critical habitat, then impacts will be lower than in the case where regulations are unaffected. For example, if cities accommodate critical habitat designation by allowing for higher density development, then economic losses may be lower than if housing is even further restricted by critical habitat.

Following this line of reasoning, two scenarios are presented in this analysis. First, the more conservative scenario is that critical habitat results in a reduction in the housing stock in Census tracts where avoidance requirements place some land off-limits to development. In this case, critical habitat will result in housing price increases to clear the market and potential gains to developers and landowners who benefit from the increased price. These potential producer gains must be counterbalanced against the requirement for mitigation expenditures resulting from development in critical habitat areas, and profits lost through the reduction in housing units constructed. An alternative scenario is that critical habitat designation is accommodated entirely through densification. Consumer losses in this case result from reductions in lot size since the number of housing units is unaffected. Producer losses will result mainly from mitigation expenditures. Comparing welfare losses between the two scenarios illustrates potential gains from policy coordination among levels of government.

IV.2.3 Critical Habitat Likely To Be Developed

The method for calculating the quantity of new development per Census tract was described in the preceding section. It remains to allocate that development within the tract itself. To do so, GIS analysis was used to calculate overlap between proposed critical habitat and the development probabilities that form the basis of an urban growth model designed at the University of California, Berkeley. The California Urban and Biodiversity Analysis (CURBA) model, developed by City and Regional Planning professors, uses GIS technology to provide spatial predictions of the extent of urban growth in the year 2025.

The basis of the CURBA model is a set of econometrically estimated development probabilities that incorporate the preferences of consumers for distance and landscape features in their choice of location. These development probabilities (as opposed to the ordinal (1/0) predictions of location of development that are ultimately generated by CURBA). The probabilities also are a good indication of the degree to which consumers view alternative development sites as substitutes. By overlaying the proposed critical habitat unit areas over CURBA predictions, it is possible to measure the expected amount of development that is likely to take place within critical habitat. Furthermore, the precise nature of the CURBA model—predictions have resolution of one one-hundredths of a hectare—invests this analysis with a high degree of specificity, resulting in a more accurate impact assessment.

The CURBA model covers 17 of the 20 counties containing critical habitat. For the remaining 3, GIS is used to exclude land in critical habitats that has already been, or cannot be developed. Therefore, the impact estimates of critical habitat on land markets are limited to only those parcels which might actually support development.

To determine already developed land, GIS data is used from the California Fire and Resource Assessment Program (FRAP). The FRAP data delineates areas of land with a structural density of one unit per acre or higher. To determine land that is not developable, the analysis excludes those portions of critical habitat which meet one or more of the following criteria (unless otherwise noted, the features listed were obtained from GIS data provided by ESRI, the leading GIS provider):

- Land that is classified as “prime farmland” by the California Farmland Mapping and Monitoring Program (FMMP).
- Land that is under water. These features include rivers, reservoirs, intermittent reservoirs, lakes, intermittent lakes, streams, and canals.
- Land that is on or within two meters of a major highway, minor highway, major road or railroad.
- Land that is on the property of an airport.
- Land owned by the federal government. This includes land holdings of the Bureau of Land Management, National Forest Service, National Park Service, or the Department of Defense.
- Land forming part of an American Indian reservation or tribal lands.
- Land that cannot be developed due to geography. This includes land within the 100-year flood plane as determined by the Federal Emergency Management Agency, and land that is sloped at more than a 20% grade.

IV.2.4 Avoidance, Mitigation and Indirect Effects of Critical Habitat

Interviews with Service personnel, as well as a comprehensive examination of the Service’s consultation history, resulted in estimates that the average private development project sited in proposed critical habitat will be subject to a 2:1 mitigation ratio for impacts to each acre of upland habitat, where the CTS aestivates. For breeding habitat, it was assumed that projects will be subject to a 1:1 avoidance requirement and a 3:1

mitigation requirement on the remaining land. A review of the Service's consultation history for residential development projects revealed breeding habitat comprises, on average, about 5% of the overall tiger salamander habitat.

Projects may fulfill the requirement for compensation by purchasing conservation credits from a conservation bank, purchasing suitable habitat and managing that habitat in perpetuity, or dedicating land already owned by the project applicant and having suitable habitat.

Conservation bank prices are used to estimate the project modification costs associated with section 7 requirements. The analysis uses market data collected from several private conservation banks in the Bay Area and central California regions to determine off-site mitigation prices by county. These prices represent the blended average of the costs of mitigation for both upland and breeding habitat; they reflect simultaneously the higher cost of mitigating for breeding habitat versus upland and the greater prevalence of upland habitat, as well as differences in regional land prices. Mitigation land was assumed to cost an average of $10,000 per acre in the San Joaquin and Central Valley regions, and $15,000 in the Sacramento, Central Coast and East Bay regions.[61]

The Section 7 consultation process may result in time delays and other effects that have impacts that are incremental to direct compliance costs. If such effects would not have occurred in the absence of critical habitat (i.e., "but for" critical habitat), then they are considered by this analysis to be an impact of the designation.

These costs include project delays stemming from the consultation process or compliance with other regulations, or, in the case of land location within or adjacent to the designation, loss in property values due to regulatory uncertainty, and loss (or gain) in property values resulting from public perceptions regarding the effects of critical habitat.

Both public and private entities may experience incremental time delays for projects and other activities due to requirements associated with the Section 7 consultation process and / or compliance with other laws triggered by the designation. The need to conduct a Section 7 consultation will not necessarily delay a project, as often the consultation may be coordinated with the existing baseline regulatory approval process. However, depending on the schedule of the consultation, a project may experience additional delays, resulting in an unanticipated extension in the time needed to fully realize returns from the planned activity.

To the extent that delays result from the designation, they are considered in the analysis. Specifically, the analysis considers costs associated with any incremental time delays associated with Section 7 consultation or other requirements triggered by the designation above and beyond project delays resulting from baseline regulatory processes. The average time of a Section 7 consultation, 111 days, was determined based on Service records of vernal pool technical assistance provided to private developers.

[61] These estimates were derived from personal interviews with developers, conservation bank administrators and other affected entities.

IV.3 CALCULATION OF MARKET EFFECTS AND WELFARE LOSSES

IV.3.1 Summary

Estimates of welfare impacts on the markets for land, housing and other goods proceed directly from the spatial and socioeconomic data described above. This analysis adopts a supply and demand approach based on partial equilibrium to assess those impacts.

Estimating the regulatory impact requires several steps within the context of this framework:

1. Identify the supply and demand functions and determine the market equilibrium "but for" the regulatory action.
2. Determine the effects of regulation on supply, demand and relevant constraints.
3. Estimate the resulting new market equilibrium and resultant changes in producer and consumer surplus.

Because of its conservatism, the rationed housing scenario is the base case. In this scenario, critical habitat reduces the number of new housing units built, and welfare impacts can be calculated only after specifying a demand function for housing as well as costs of building and development. The densification scenario requires specification of a demand function for land together with land prices equal to intensive margin values. In both scenarios, critical habitat will result in economic welfare impacts that are distributed among consumers, builders, developers and landowners. More detail on the mathematical model for calculating impacts is given in the appendix.

New residents' demand for housing in each Census tract is specified as linear and of unit price elasticity as suggested by the academic literature.[62] The number of new housing units is taken from the population growth forecasts and new home prices are taken from DataQuick as described above.

For the densification scenario, the land demand function is also specified as linear, with the own-price elasticity set at one.[63] The quantity of land demanded in each Census tract

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[62] The seminal analysis of Muth (1964) suggested that the price elasticity of demand for residential land could be expressed as $\varepsilon_L = -k_N\sigma + k_L\varepsilon_H$, where ε_L and ε_H are the own-price elasticities of residential land and housing, respectively, σ is the elasticity of substitution between land and capital in the production of housing, and k_L and k_N are the shares of land and non-land factors in housing production. Thorsnes (1997) has estimated the value of σ as roughly -1.0. Reid (1962) first demonstrated that the price elasticity of housing was near -1.0. While several studies have reported lower elasticities, Rosen (1979) reported a price elasticity of -1.0 using time series data. Representative cost shares for land and non-land factors of production are 0.3 and 0.7, respectively. Richard Muth, "The Derived Demand for a Factor of Production and the Industry Supply Curve," *Oxford Economic Papers* (July 1964): 221-234; Paul Thorsnes, "Consistent Estimates of the Elasticity of Substitution between Land and Non-Land Inputs in the Production of Housing," *Journal of Urban Economics* (1997): 98-108; Harvey Rosen, "Housing Decisions and the U.S. Income Tax," *Journal of Public Economics* (1979): 1-23.

[63] Gyourko and Voight (2001) review the literature on the demand for residential land and report elasticity estimates ranging from -0.7 to -1.6. The assumption of a land price elasticity of -1.0 is consistent with the analysis in the previous footnote if the price elasticity of housing demand is also -1.0.

is taken by combining population growth forecasts with county-specific urban densities as described earlier. The price of land is calculated econometrically and is equal to the intensive margin value of land in each county. Mean marginal land values are close to $3 per square foot across the study area.

The indirect effects of critical habitat resulting from delay in project completion result from the fact that producers and consumers receive the benefits of housing development later than would have been the case without the incremental regulation and need for Section 7 consultation. As discussed in the previous section, the assumed period of delay is relatively brief (111 days). However, it is important to remember that delay affects the entire amount of consumer and producer surplus from new housing, which is quite large in a rapidly growing area like California. Thus, the effects of delay may be significant even though the delay period is only a few months rather than years.

IV.3.2 Sample Calculation

A sample calculation is provided to assist with understanding the rationed housing model. Consider a hypothetical census tract with the following characteristics:

- 200 new homes are projected to be built at a cost of $100,000 each;
- The cost of building each of these homes is $80,000;
- Housing demand is unit elastic, meaning an increase in price will provoke an equivalent (in percent terms) reduction in demand; and
- The price of mitigation land is $10,000 per acre.

Suppose the CURBA model reveals that 100 of the projected 200 homes are to be built within critical habitat. Using the probabilities and mitigation ratios set forth in Section IV.2.4, this implies an output reduction of approximately 3 homes, or 1.5% of the overall pre-regulation housing stock:[64]

$$Q' = Q_0\left[1 - M \times P(\text{breeding})\right] = 100\left[1 - .5(.05)\right] \approx 97,$$

where Q_0 is the initial quantity of housing within critical habitat, M is the avoidance requirement (expressed as a decimal), and $P(\text{breeding})$ is the percent critical habitat is used for breeding.

Since demand is unit elastic, this implies a 1.5% increase in the overall price of new housing, so the post-regulation price of new housing is now $101,500:

$$\frac{dQ}{Q_0}\frac{P_0}{dP} = -1 \Rightarrow \frac{dQ}{Q_0} = -\frac{dP}{P_0}$$

$$\frac{dQ}{Q_0} = \frac{Q' - Q_0}{Q_0} \approx -.015 \Rightarrow \frac{dP}{P_0} = .015$$

[64] Figures have been rounded for simplicity.

The welfare loss calculation has three components. First are impacts to producer and consumer surplus.[65] The surplus impacts for this example total $62,250.

Second are mitigation costs. Using the above assumptions, developers must mitigate 2:1 on upland habitat and 3:1 on non-avoided breeding habitat at a cost of $10,000 upland and $100,000 breeding. Calculating the total land footprint within critical habitat requires knowledge of the incremental gross urban density. Assume it is two homes per acre. Then a total of 47.5 acres of upland habitat must be mitigated at 2:1, and an additional 2.5 of breeding habitat at 3:1. This yields a total of $1.7 million in mitigation costs:

$$C_M = P_U R_U Q_U + P_B R_B Q_B = 10000(2)(47.5) + 100000(3)(2.5) = 1700000,$$

where *P*, *R* and *Q* are the prices, mitigation ratios and quantities for breeding and upland habitat.

The final component of welfare loss is due to delay. Delay is calculated using a 7% discount rate for 111 days, using the standard discounting formula. Delay is applied to the surplus realized on every house built within critical habitat. Delay costs for in this example equal roughly $120,000.

Total lost surplus in this example is approximately $1.9 million.

IV.4 Results of the Analysis

In the base scenario where critical habitat reduces the amount of new housing, designation of critical habitat results in over $441 million in losses to consumers and producers between the present and 2025. In the event that on-site avoidance can be accomplished through density increases alone, welfare losses from critical habitat are $371 million over the same time period. Table IV-2: Market Impacts of Designation shows how critical habitat perturbs the housing market equilibrium in the case where critical habitat results in construction of fewer housing units. For each Census tract, the table shows the number of new housing units projected to be built in critical habitat, as well as change due to regulation.

On-site avoidance requirements result in the loss of a certain number of housing units. The market price of housing must increase to clear the market and reestablish a new equilibrium. The last two columns display the pre-regulation price of new housing and the imputed change in the price of housing resulting from protection of critical habitat. The predicted price changes are modest when viewed in relation to the generally high price of new housing in the study area. However, these price increases are applied to all new housing to be built in the Census tracts containing critical habitat since this is the relevant market. Thus, critical habitat may cause housing market impacts well outside of the immediate footprint of critical habitat.

Table IV-3: Welfare Impacts of Designation combines these market impacts with mitigation expenditures to arrive at welfare losses in each Census tract, along with annualized impacts. (Table IV-4: Welfare Impacts, Descending Order presents these

[65] These are given by the formula, given by the formula $-\left[\frac{dP}{2} + (P - c)\right] dQ$; see Section VIII.

impacts in descending order.) Losses per Census tract range from $0 to over $68 million for the rationed housing analysis.

Table IV-5: County-Level Impacts As a Percent of Income displays impacts at the county level normalized by the aggregate household income in each county.

Table IV-1: Socioeconomic Characteristics of Affected Tracts

FIPS	County	Median Home Price	Average Square Footage	Projected Population Increase	New Households
06001435101	Alameda	$832,275	2,519	2,707	940
06001441100	Alameda	$659,709	3,108	714	239
06001441503	Alameda	$656,521	1,706	3,319	786
06001442000	Alameda	$1,369,616	2,880	576	187
06001450100	Alameda	$810,603	2,348	8,236	2,986
06001450601	Alameda	$1,694,725	4,107	1,300	479
06001450701	Alameda	$1,876,081	4,617	2,109	734
06001450721	Alameda	$715,850	2,236	6,155	2,319
06001451101	Alameda	$646,197	2,055	5,704	2,054
06001451202	Alameda	$599,200	1,670	3,121	1,077
06005000302	Amador	$335,293	1,704	1,778	679
06009000210	Calaveras	$311,922	1,764	4,582	1,706
06009000220	Calaveras	$310,528	1,768	4,601	1,664
06013303200	Contra Costa	$520,547	2,380	14,156	4,882
06013304000	Contra Costa	$558,082	2,682	2,269	864
06013313103	Contra Costa	$500,113	2,602	2,223	793
06013313202	Contra Costa	$389,063	1,894	1,715	578
06013355104	Contra Costa	$1,154,277	3,085	9,275	3,672
06013355106	Contra Costa	$539,420	2,835	3,741	1,311
06013355200	Contra Costa	$527,238	2,472	8,744	3,061
06013355304	Contra Costa	$868,568	2,848	1,238	484
06019005503	Fresno	$390,536	2,388	5,600	2,008
06019005515	Fresno	$745,634	3,875	5,839	2,127
06019006401	Fresno	$336,794	2,229	5,379	1,871
06019006403	Fresno	$197,789	1,827	875	325
06029004500	Kern	$161,913	1,398	1,888	388
06031000100	Kings	$289,567	2,085	435	140
06039000102	Madera	$282,198	1,971	1,545	621
06039000105	Madera	$225,329	1,986	5,481	2,071
06039000509	Madera	$246,820	1,836	1,258	387
06039001000	Madera	$264,274	2,047	1,843	528
06043000100	Mariposa	$287,575	1,857	1,853	785
06047000100	Merced	$200,691	1,819	310	102
06047000400	Merced	$295,165	1,736	4,477	1,440
06047000901	Merced	$188,600	1,431	377	111

FIPS	County	Median Home Price	Average Square Footage	Projected Population Increase	New Households
06047001901	Merced	$214,923	1,271	1,818	426
06047001902	Merced	$163,304	1,857	1,983	550
06047002000	Merced	$341,305	2,131	2,640	897
06047002100	Merced	$377,961	2,206	1,965	609
06053010501	Monterey	$638,003	2,274	13,552	4,256
06053010606	Monterey	$426,336	1,743	33,851	8,593
06053010701	Monterey	$1,108,930	3,781	2,449	846
06053010702	Monterey	$1,099,751	2,539	451	172
06053010801	Monterey	$440,985	1,971	14,627	3,358
06053011000	Monterey	$946,702	2,085	401	164
06053011101	Monterey	$284,883	1,234	247	55
06053011102	Monterey	$392,156	1,582	22,350	5,082
06053011301	Monterey	$187,614	1,207	12,224	3,136
06053011400	Monterey	$207,516	1,895	1,486	515
06053013200	Monterey	$1,120,357	4,425	874	334
06053014103	Monterey	$553,777	1,857	5,659	1,892
06067009404	Sacramento	$380,438	2,263	1,030	340
06067009406	Sacramento	$352,231	1,932	273	90
06069000100	San Benito	$635,159	2,198	1,165	332
06069000500	San Benito	$390,504	2,122	5,519	1,487
06069000600	San Benito	$595,190	2,236	3,851	1,158
06069000800	San Benito	$807,560	2,350	2,525	905
06077004702	San Joaquin	$322,583	2,538	3,963	1,273
06077004800	San Joaquin	$360,668	2,131	127	41
06079010300	San Luis Obispo	$366,293	2,122	9,046	3,130
06085503312	Santa Clara	$961,494	3,949	817	223
06085503319	Santa Clara	$885,975	2,732	1,284	329
06085511911	Santa Clara	$1,778,010	4,630	887	234
06085512100	Santa Clara	$837,203	2,160	13,708	4,648
06085512200	Santa Clara	$1,124,946	7,625	587	158
06085512401	Santa Clara	$1,748,857	3,991	445	108
06085512402	Santa Clara	$1,089,703	3,712	350	82
06085512602	Santa Clara	$758,558	2,009	437	97
06085512700	Santa Clara	$1,272,126	2,312	704	266
06095253500	Solano	$366,065	1,619	12,782	5,037
06099000101	Stanislaus	$426,469	2,339	5,990	2,104
06099002801	Stanislaus	$243,527	1,383	2,832	823

FIPS	County	Median Home Price	Average Square Footage	Projected Population Increase	New Households
06099002901	Stanislaus	$354,485	2,100	699	231
06107000202	Tulare	$257,105	1,971	608	162
06107000302	Tulare	$116,952	1,668	785	181
06107000600	Tulare	$140,442	1,781	906	195
06107000800	Tulare	$145,735	1,857	4,305	1,171
06107000900	Tulare	$130,682	1,895	2,031	466
06113011400	Yolo	$252,865	1,857	4,173	1,357
06113011500	Yolo	$272,347	1,895	972	310
Total				**324,801**	**102,222**

Table IV-2: Market Impacts of Designation

FIPS	County	Projected New Housing	Pre-Regulation Housing Price	Change in Housing Price
06001435101	Alameda	940	$832,275	$5
06001441100	Alameda	239	$659,709	$1,276
06001441503	Alameda	786	$656,521	$14,563
06001442000	Alameda	187	$1,369,616	$1,143
06001450100	Alameda	2,986	$810,603	$6,121
06001450601	Alameda	479	$1,694,725	$0
06001450701	Alameda	734	$1,876,081	$27,623
06001450721	Alameda	2,319	$715,850	$13,094
06001451101	Alameda	2,054	$646,197	$3,747
06001451202	Alameda	1,077	$599,200	$1,130
06005000302	Amador	679	$335,293	$286
06009000210	Calaveras	1,706	$311,922	$514
06009000220	Calaveras	1,664	$310,528	$565
06013303200	Contra Costa	4,882	$520,547	$315
06013304000	Contra Costa	864	$558,082	$4,153
06013313103	Contra Costa	793	$500,113	$1,067
06013313202	Contra Costa	578	$389,063	$6,136
06013355104	Contra Costa	3,672	$1,154,277	$6,888
06013355106	Contra Costa	1,311	$539,420	$5,437
06013355200	Contra Costa	3,061	$527,238	$3,947
06013355304	Contra Costa	484	$868,568	$3,879
06019005503	Fresno	2,008	$390,536	$20
06019005515	Fresno	2,127	$745,634	$5,583
06019006401	Fresno	1,871	$336,794	$473
06019006403	Fresno	325	$197,789	$146
06029004500	Kern	388	$161,913	$7
06031000100	Kings	140	$289,567	$95
06039000102	Madera	621	$282,198	$446
06039000105	Madera	2,071	$225,329	$180
06039000509	Madera	387	$246,820	$1
06039001000	Madera	528	$264,274	$299
06043000100	Mariposa	785	$287,575	$18
06047000100	Merced	102	$200,691	$242
06047000400	Merced	1,440	$295,165	$0
06047000901	Merced	111	$188,600	$84
06047001901	Merced	426	$214,923	$1,108

FIPS	County	Projected New Housing	Pre-Regulation Housing Price	Change in Housing Price
06047001902	Merced	550	$163,304	$210
06047002000	Merced	897	$341,305	$597
06047002100	Merced	609	$377,961	$60
06053010501	Monterey	4,256	$638,003	$4,508
06053010606	Monterey	8,593	$426,336	$5
06053010701	Monterey	846	$1,108,930	$138
06053010702	Monterey	172	$1,099,751	$6
06053010801	Monterey	3,358	$440,985	$16
06053011000	Monterey	164	$946,702	$212
06053011101	Monterey	55	$284,883	$211
06053011102	Monterey	5,082	$392,156	$45
06053011301	Monterey	3,136	$187,614	$61
06053011400	Monterey	515	$207,516	$42
06053013200	Monterey	334	$1,120,357	$57
06053014103	Monterey	1,892	$553,777	$5,126
06067009404	Sacramento	340	$380,438	$594
06067009406	Sacramento	90	$352,231	$1,228
06069000100	San Benito	332	$635,159	$250
06069000500	San Benito	1,487	$390,504	$246
06069000600	San Benito	1,158	$595,190	$5,320
06069000800	San Benito	905	$807,560	$1,218
06077004702	San Joaquin	1,273	$322,583	$363
06077004800	San Joaquin	41	$360,668	$592
06079010300	San Luis Obispo	3,130	$366,293	$5
06085503312	Santa Clara	223	$961,494	$1,275
06085503319	Santa Clara	329	$885,975	$0
06085511911	Santa Clara	234	$1,778,010	$9,771
06085512100	Santa Clara	4,648	$837,203	$2,098
06085512200	Santa Clara	158	$1,124,946	$906
06085512401	Santa Clara	108	$1,748,857	$6,500
06085512402	Santa Clara	82	$1,089,703	$731
06085512602	Santa Clara	97	$758,558	$392
06085512700	Santa Clara	266	$1,272,126	$4,307
06095253500	Solano	5,037	$366,065	$309
06099000101	Stanislaus	2,104	$426,469	$1,375
06099002801	Stanislaus	823	$243,527	$7
06099002901	Stanislaus	231	$354,485	$85

FIPS	County	Projected New Housing	Pre-Regulation Housing Price	Change in Housing Price
06107000202	Tulare	162	$257,105	$211
06107000302	Tulare	181	$116,952	$93
06107000600	Tulare	195	$140,442	$84
06107000800	Tulare	1,171	$145,735	$6
06107000900	Tulare	466	$130,682	$205
06113011400	Yolo	1,357	$252,865	$189
06113011500	Yolo	310	$272,347	$13
Total		**102,222**		

Table IV-3: Welfare Impacts of Designation

		Rationing		Densification	
FIPS	**County**	**Surplus Lost**	**Annualized Impacts**	**Surplus Lost**	**Annualized Impacts**
06001450721	Alameda	$68,357,184	$6,030,313	$57,567,012	$5,078,429
06013355104	Contra Costa	$43,721,380	$3,856,999	$34,294,780	$3,025,406
06053010501	Monterey	$42,654,944	$3,762,921	$32,880,134	$2,900,610
06001450701	Alameda	$37,760,320	$3,331,128	$30,009,640	$2,647,381
06001451101	Alameda	$32,343,348	$2,853,255	$35,567,008	$3,137,639
06001450100	Alameda	$30,483,876	$2,689,217	$22,039,106	$1,944,239
06053014103	Monterey	$22,393,324	$1,975,487	$17,370,280	$1,532,366
06085512100	Santa Clara	$22,264,860	$1,964,155	$18,500,836	$1,632,101
06001441503[66]	Alameda	$19,553,670	$1,724,980	$15,646,254	$1,380,276
06013355200	Contra Costa	$17,426,460	$1,537,322	$14,183,854	$1,251,267
06069000600	San Benito	$14,625,198	$1,290,201	$11,417,381	$1,007,215
06019005515	Fresno	$13,393,774	$1,181,568	$10,571,900	$932,629
06013355106	Contra Costa	$11,254,393	$992,837	$10,764,228	$949,595
06013313202	Contra Costa	$6,345,317	$559,769	$6,004,490	$529,702
06013304000	Contra Costa	$5,972,718	$526,899	$5,564,642	$490,900
06095253500	Solano	$5,529,894	$487,834	$6,366,429	$561,632
06099000101	Stanislaus	$4,651,356	$410,332	$3,445,067	$303,916
06085511911	Santa Clara	$4,424,812	$390,347	$3,442,413	$303,682
06001451202	Alameda	$4,193,285	$369,922	$4,297,702	$379,133
06085512700	Santa Clara	$4,067,012	$358,782	$4,134,128	$364,703
06013355304	Contra Costa	$2,820,527	$248,820	$2,162,003	$190,727
06009000220	Calaveras	$2,756,193	$243,145	$2,609,272	$230,184
06009000210	Calaveras	$2,536,540	$223,768	$2,383,415	$210,259
06069000800	San Benito	$2,328,210	$205,389	$1,680,228	$148,226
06013303200	Contra Costa	$2,277,352	$200,903	$2,015,997	$177,847
06047001901	Merced	$1,669,065	$147,241	$1,528,582	$134,848
06085512401	Santa Clara	$1,380,906	$121,820	$1,083,543	$95,588
06019006401	Fresno	$1,249,825	$110,257	$1,092,862	$96,410
06013313103	Contra Costa	$1,180,791	$104,167	$1,063,069	$93,781
06047002000	Merced	$1,146,306	$101,124	$967,016	$85,308
06069000500	San Benito	$972,021	$85,749	$872,414	$76,962
06113011400	Yolo	$810,106	$71,466	$799,046	$70,490

[66] Impacts for tract 06001441503 incorporate revised growth forecasts received from county planning agencies.

		Rationing		Densification	
FIPS	**County**	**Surplus Lost**	**Annualized Impacts**	**Surplus Lost**	**Annualized Impacts**
06053011301	Monterey	$794,889	$70,123	$794,118	$70,055
06039000105	Madera	$767,305	$67,690	$754,421	$66,553
06077004702	San Joaquin	$697,315	$61,516	$686,253	$60,540
06053011102	Monterey	$674,340	$59,489	$607,608	$53,602
06039000102	Madera	$625,269	$55,160	$524,066	$46,232
06085503312	Santa Clara	$517,759	$45,676	$490,199	$43,244
06005000302	Amador	$499,942	$44,104	$462,702	$40,818
06039001000	Madera	$422,397	$37,263	$379,796	$33,505
06001442000	Alameda	$377,311	$33,286	$284,562	$25,103
06001441100	Alameda	$362,464	$31,976	$427,954	$37,753
06047001902	Merced	$362,457	$31,975	$372,544	$32,865
06107000900	Tulare	$354,699	$31,291	$397,064	$35,028
06067009404	Sacramento	$349,024	$30,790	$325,474	$28,713
06069000100	San Benito	$201,281	$17,757	$155,789	$13,743
06085512200	Santa Clara	$200,427	$17,681	$238,271	$21,020
06067009406	Sacramento	$186,889	$16,487	$181,544	$16,015
06053010701	Monterey	$180,771	$15,947	$137,640	$12,142
06053010801	Monterey	$146,741	$12,945	$131,721	$11,620
06085512402	Santa Clara	$133,946	$11,816	$124,833	$11,012
06053010606	Monterey	$120,745	$10,652	$104,804	$9,246
06085512602	Santa Clara	$110,987	$9,791	$105,447	$9,302
06107000202	Tulare	$92,196	$8,133	$83,137	$7,334
06047002100	Merced	$78,434	$6,919	$66,040	$5,826
06053011000	Monterey	$71,428	$6,301	$48,796	$4,305
06107000302	Tulare	$69,540	$6,135	$77,555	$6,842
06019006403	Fresno	$66,321	$5,851	$68,973	$6,085
06047000100	Merced	$65,526	$5,781	$61,959	$5,466
06107000600	Tulare	$64,961	$5,731	$69,922	$6,168
06053011400	Monterey	$61,299	$5,408	$62,327	$5,498
06019005503	Fresno	$59,991	$5,292	$48,726	$4,299
06077004800	San Joaquin	$45,992	$4,057	$38,722	$3,416
06053011101	Monterey	$42,016	$3,707	$39,657	$3,498
06079010300	San Luis Obispo	$34,906	$3,079	$30,632	$2,702
06099002901	Stanislaus	$33,006	$2,912	$25,432	$2,244
06031000100	Kings	$31,530	$2,781	$27,126	$2,393
06043000100	Mariposa	$29,581	$2,610	$23,964	$2,114

		Rationing		Densification	
FIPS	**County**	**Surplus Lost**	**Annualized Impacts**	**Surplus Lost**	**Annualized Impacts**
06047000901	Merced	$28,520	$2,516	$26,999	$2,382
06053013200	Monterey	$24,070	$2,123	$19,438	$1,715
06107000800	Tulare	$22,394	$1,976	$24,145	$2,130
06113011500	Yolo	$12,847	$1,133	$12,460	$1,099
06099002801	Stanislaus	$12,757	$1,125	$10,207	$900
06029004500	Kern	$11,674	$1,030	$11,759	$1,037
06001435101	Alameda	$7,629	$673	$6,169	$544
06053010702	Monterey	$1,861	$164	$1,326	$117
06047000400	Merced	$1,428	$126	$1,221	$108
06039000509	Madera	$717	$63	$656	$58
06001450601	Alameda	$0	$0	$0	$0
06085503319	Santa Clara	$0	$0	$0	$0
Total		**$441,602,546**	**$38,957,155**	**$370,898,884**	**$32,719,842**

Table IV-4: Welfare Impacts, Descending Order

FIPS	County	Surplus Lost
06001450721	Alameda	$68,357,184
06013355104	Contra Costa	$43,721,380
06053010501	Monterey	$42,654,944
06001450701	Alameda	$37,760,320
06001451101	Alameda	$32,343,348
06001450100	Alameda	$30,483,876
06053014103	Monterey	$22,393,324
06085512100	Santa Clara	$22,264,860
06001441503	Alameda	$19,553,670
06013355200	Contra Costa	$17,426,460
06069000600	San Benito	$14,625,198
06019005515	Fresno	$13,393,774
06013355106	Contra Costa	$11,254,393
06013313202	Contra Costa	$6,345,317
06013304000	Contra Costa	$5,972,718
06095253500	Solano	$5,529,894
06099000101	Stanislaus	$4,651,356
06085511911	Santa Clara	$4,424,812
06001451202	Alameda	$4,193,285
06085512700	Santa Clara	$4,067,012
06013355304	Contra Costa	$2,820,527
06009000220	Calaveras	$2,756,193
06009000210	Calaveras	$2,536,540
06069000800	San Benito	$2,328,210
06013303200	Contra Costa	$2,277,352
06047001901	Merced	$1,669,065
06085512401	Santa Clara	$1,380,906
06019006401	Fresno	$1,249,825
06013313103	Contra Costa	$1,180,791
06047002000	Merced	$1,146,306
06069000500	San Benito	$972,021
06113011400	Yolo	$810,106
06053011301	Monterey	$794,889
06039000105	Madera	$767,305
06077004702	San Joaquin	$697,315
06053011102	Monterey	$674,340
06039000102	Madera	$625,269

FIPS	County	Surplus Lost
06085503312	Santa Clara	$517,759
06005000302	Amador	$499,942
06039001000	Madera	$422,397
06001442000	Alameda	$377,311
06001441100	Alameda	$362,464
06047001902	Merced	$362,457
06107000900	Tulare	$354,699
06067009404	Sacramento	$349,024
06069000100	San Benito	$201,281
06085512200	Santa Clara	$200,427
06067009406	Sacramento	$186,889
06053010701	Monterey	$180,771
06053010801	Monterey	$146,741
06085512402	Santa Clara	$133,946
06053010606	Monterey	$120,745
06085512602	Santa Clara	$110,987
06107000202	Tulare	$92,196
06047002100	Merced	$78,434
06053011000	Monterey	$71,428
06107000302	Tulare	$69,540
06019006403	Fresno	$66,321
06047000100	Merced	$65,526
06107000600	Tulare	$64,961
06053011400	Monterey	$61,299
06019005503	Fresno	$59,991
06077004800	San Joaquin	$45,992
06053011101	Monterey	$42,016
06079010300	San Luis Obispo	$34,906
06099002901	Stanislaus	$33,006
06031000100	Kings	$31,530
06043000100	Mariposa	$29,581
06047000901	Merced	$28,520
06053013200	Monterey	$24,070
06107000800	Tulare	$22,394
06113011500	Yolo	$12,847
06099002801	Stanislaus	$12,757
06029004500	Kern	$11,674

FIPS	County	Surplus Lost
06001435101	Alameda	$7,629
06053010702	Monterey	$1,861
06047000400	Merced	$1,428
06039000509	Madera	$717
06001450601	Alameda	$0
06085503319	Santa Clara	$0
Total		**$441,602,546**

Table IV-5: County-Level Impacts As a Percent of Income

County	Surplus Lost	Average Household Income, $2005[67]	Percent Impacts
Alameda	$193,439,087	$44,509,009,077	0.43%
Contra Costa	$90,998,938	$33,718,896,198	0.27%
Monterey	$67,166,426	$9,067,369,779	0.74%
Santa Clara	$33,100,709	$63,751,686,804	0.05%
San Benito	$18,126,710	$1,281,531,654	1.41%
Fresno	$14,769,911	$14,183,463,177	0.10%
Solano	$5,529,894	$9,802,150,722	0.06%
Calaveras	$5,292,733	$1,012,043,682	0.52%
Stanislaus	$4,697,119	$8,741,436,912	0.05%
Merced	$3,351,736	$3,454,698,663	0.10%
Madera	$1,815,686	$2,035,517,562	0.09%
Yolo	$822,954	$3,746,360,709	0.02%
San Joaquin	$743,307	$11,230,335,207	0.01%
Tulare	$603,790	$5,935,972,068	0.01%
Sacramento	$535,913	$29,760,155,802	0.00%
Amador	$499,942	$816,590,385	0.06%
San Luis Obispo	$34,906	$6,027,011,523	0.00%
Kings	$31,530	$1,962,103,572	0.00%
Mariposa	$29,581	$345,248,280	0.01%
Kern	$11,674	$11,507,243,553	0.00%
Total	**$441,602,546**	**$262,888,825,329**	**0.17%**

[67] Figures are derived from 2000 Census and have been inflated using the consumer price index.

V ECONOMIC IMPACTS ON PUBLIC PROJECTS AND ACTIVITIES

This section reviews the potential economic impacts on transportation projects and the energy industry as a result of critical habitat designation. In addition, the possible impacts to activities by the Department of the Defense, the Bureau of Land Management, the Bureau of Reclamation, the Forestry Service, the Fish and Wildlife Service, and the Bureau of Indian Affairs are examined.

V.1 ECONOMIC IMPACTS ON TRANSPORTATION PROJECTS

The Federal Highway Administration (FHA) and the California Department of Transportation maintain GIS databases of current and predicted transportation projects. The FHA data, known as the National Highway Planning Network, includes information for interstates, principal arterials, and rural minor arterials.[68] The California Department of Transportation source, known as the California Transportation Investment Tool (CTIS Tool), incorporates information about projects overseen by the State Transportation Improvement Program, the State Highway Operations and Protection Program, the Interregional Transportation Strategic Plan, the California Aviation System Plan, and various regional transportation planning organizations.[69] Aviation, rail, highway, transit, bicycle and pedestrian projects are all represented. Developed to assist transportation planners, the CTIS Tool is a Geographic Information System that displays the mapped location, as well as the timeframe and cost of the projects. Version 1.3.2 was used for this analysis; version 2.0 should be released in spring 2005.[70]

The data layers contained in the CTIS Tool were mapped onto the habitat boundary files provided by the Service to determine the number of proposed acres affected by each transportation project. No aviation, rail, bicycle, transit, or pedestrian projects overlapped with critical habitat. Table V-1: California Highway Projects that Intersect Critical Habitat displays the highway number, miles of impacted acres, total project cost (in 2004 dollars), and county location of the three California projects that cross CTS habitat units.[71] The capital costs of all of the impacted projects total $102 million, in 2004 dollars. A total of 2.90 miles of California highway projects overlap with critical habitat units. No impacts were identified from the overlap of the FHA data and the critical habitat maps. To determine the effects of designation, the impacts of mitigation requirements and project delays were calculated. For the analysis, only projects with a start date of 2005 or later were considered.[72]

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[68] U.S. Department of Transportation, Federal Highway Administration, http://www.fhwa.dot.gov/planning/nhpn/

[69] California Department of Transportation, Office of State Planning, http://www.dot.ca.gov/hq/tpp/offices/osp/ctis.htm

[70] Version 1.3.2 is current through 2001. This analysis will be updated once Version 2.0 is released.

[71] Values were inflated to 2004 dollars by using the Producer Price Indexes for Construction Materials and Components, recorded in Table B-65 of the Economic Report of the President, published in February 2005.

[72] Start date of a project was determined by the "Line_yr" variable, which represents the "year the funding is expected to be awarded for expenditures". The "Total_Cost" variable equals the total funds set aside for the project. The "Doc_Year" identifies the year the transportation project was approved, and therefore, the base year from which the project costs are inflated to 2004 dollars (CTIS Data Dictionary, 2000).

Using the information in the CTIS Tool, two future projects on Routes 156 and 25 in San Benito County were found to intersect critical habitat. According to staff at Caltrans District 5, the environmental assessment for the Route 156 project is complete and no habitat mitigation is required.[73] The impact analysis for Route 25 will be finished in 2007, therefore, the effect on critical habitat has not yet been determined. For the purpose of this analysis, we estimated the potential impact to the project due to mitigation. It was assumed that each highway project would require a 250-foot buffer to each side of the structure, thereby increasing the width of the project by 500 feet. Applying this premise increased the amount of critical habitat impacted by transportation projects.[74,75]

One transportation project in Alameda County was also identified as overlapping with CTS habitat. The environmental assessment for this project – to occur on Highway 680 -- is complete. The study names other species, in addition to the CTS, that will be affected by the project. In total, 13.69 acres of habitat will be permanently affected. At this point, we have not determined the amount of CTS habitat that will be mitigated.[76]

Two projects in San Benito County overlap critical habitat. 1.89 miles of the planned Route 25 widening will occur within critical habitat, for a total of 114.5 affected acres. The estimated cost for mitigation for this project is $4.5 million. The Route 156 project will affect roughly 9 acres of critical habitat, and will face an addition $361,000 in mitigation costs due to designation.

To determine the costs stemming from the delays in project completion, it is necessary to calculate the forgone benefits, which are best framed in terms of changes in ridership patterns and commute times. At this time, the economic impacts due to project delays have not been evaluated.

V.2 Economic Impacts on the Energy Industry

Pursuant to Executive Order 13211, Federal agencies are required to submit a summary of the potential effects of regulatory actions on the supply, distribution, and use of energy, assuming those actions meet certain criteria outlined by the OMB:[77]

- Reductions in crude oil supply in excess of 10,000 barrels per day;
- Reductions in fuel production in excess of 4,000 barrels per day;
- Reductions in coal production in excess of 5 million tons per year;

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[73] Conversation with Caltrans District 5 staff, May 11, 2005.

[74] State law requires 250-yard wide extensions on either side of new utility projects and this requirement is assumed to apply to transportation projects.

[75] The 250-foot buffer is an estimate of the average right-of-way width for road construction. Actual right-of-way widths vary within a highway, making it difficult to give an average for the entire highway. Identification of the highway projects by critical habitat unit will allow Service personnel to develop better impact estimates in collaboration with CalTrans.

[76] Initial Study with Proposed Negative Declaration Environmental Assessment, U.S Department of Transportation, Federal Highway Administration and The State of California Department of Transportation, 2004, p. 37

[77] U.S. Office of Management and Budget, "Memorandum for Heads Of Executive Departments And Agencies, And Independent Regulatory Agencies," July 13, 2001.

- Reductions in natural gas production in excess of 25 million mcf per year;
- Reductions in electricity production in excess of 1 billion kilowatt-hours per year or in excess of 500 megawatts of installed capacity;
- Increases in energy use required by the regulatory action that exceed any of the thresholds above;
- Increases in the cost of energy production in excess of one percent;
- Increases in the cost of energy distribution in excess of one percent; or
- Other similarly adverse outcomes.

Table V-2: Proposed Energy Facilities lists the 15 energy production facilities that are planned or under construction in the counties with critical habitat. A GIS analysis was used to compute their proximity to the nearest critical habitat designation.[78] Thirteen of those plants are at least one mile from proposed critical habitat and are judged to be at low risk of disruption.

One facility, the Sacramento Municipal Utility District's Cosumnes plant, borders the proposed critical habitat. However, the project has already begun construction and completed the permitting and environmental review processes required under State and Federal law. Specifically, the District has already completed a consultation with the Service in order to mitigate potential impacts to existing salamander populations. Compensatory mitigation habitat has been purchased in Laguna Creek mitigation bank.[79] Since mitigation has already been completed, these costs are sunk and designation is not expected to result in incremental costs.

Similarly, the East Altamont Energy Center is within one mile of the proposed habitat. The plant has also undergone a Service consultation and purchased 151 acres of suitable habitat for the Salamander and other endangered species from the Gomes Farm mitigation bank. Designation is not expected to result in incremental costs to this facility.

V.3 Economic Impacts on Public Lands

This section describes potential impacts of designation on lands administered by the Federal government. The analysis is divided among the various Federal agencies that are impacted, since each may potentially have its own set of development requirements and costs associated with designation.

An overall breakdown by agency and department of overlap between critical habitat and Federal lands is given in Table V-3: Impacted Federal lands by Agency and Department. The largest areas of overlap are administered by the Department of Defense, the National Forest Service and the Service.

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[78] Because some plants are only in the planning stages, precise location information was not available for all plants. Whenever possible, plant locations were geocoded to the nearest intersection or city block. While this may cause this section's estimates to differ slightly from the ultimate facility locations, it should not affect the results.

[79] "Commission Decision," SMUD Cosumnes Power Plant Project, September 10, 2003. California Energy Commission: CEC docket number 01-AFC-19.

V.3.1 Impact on the Department of Defense

Critical habitat intersects one Navy and three Army installations. Ford Ord is closed and is not expected to be impacted by designation. According to comments submitted by the Department of Defense, designated land on the other bases will negatively impact training activities. While this analysis does not attempt to quantify the welfare impact of a decline in military readiness, it is estimated to be substantial.

V.3.2 Impact on the Bureau of Land Management

Critical habitat intersects 3 acres of public domain land administered by the BLM. The expected impact of designation to the BLM is zero.

V.3.3 Impact on the Fish and Wildlife Service

Designation intersects 4,741 acres of national wildlife refuge and 12,593 acres of wildlife management area. As these uses are compatible with preservation of the tiger salamander, the Service is not expected to be impacted by designation.

V.3.4 Impact on the Bureau of Indian Affairs

There is no intersection between critical habitat and tribal lands and there are no anticipated economic effects due to designation.

Table V-1: California Highway Projects that Intersect Critical Habitat

County	Caltrans District	Highway Route	Affected Habitat Unit	Project Length (miles)	Project Start Year	Total Cost, (thousands)[80]	Agency	Impacted CH (miles)	Mitigation Costs
Alameda	4	680	3	11.0	2011	43,850	Metropolitan Transportation Commission	0.87	-
San Benito	5	25	15	8.2	2012	29,155	Council of San Benito County Governments	1.89	$4,553,181
San Benito	5	156	12	3.3	2006	29,155	Caltrans	0.15	$361,363
Totals	-	-		23	-	102,160	-	2.90	$4,914,545

Sources: California Transportation Investment Tool, Version 1.3.2, California Department of Transportation, Office of State Planning, http://www.dot.ca.gov/hq/tpp/offices/osp/ctis.htm; Critical Habitat Boundary Files, U.S. Fish and Wildlife Service.

[80] Values in 2004 dollars.

Table V-2: Proposed Energy Facilities

Plant	Status	Capacity (MW)	County	Nearest CHD (miles)
Avenal Combined Cycle – Duke	12-mo. AFC	600	Kings	27.61
Contra Costa – Mirant	Construction On Hold	530	Contra Costa	4.81
Cosumnes Phase 1-SMUD	Construction	500	Sacramento	0.02
East Altamont – Calpine	On Hold	1,100	Alameda	0.86
Los Esteros Combined Cycle – Calpine	12-mo. AFC	140	Santa Clara	4.24
Metcalf – Calpine	Construction	600	Santa Clara	2.54
Morro Bay – Duke	On Hold	1,200	San Luis Obispo	39.72
Pastoria Phase 2 – Calpine	Construction	250	Kern	86.30
Roseville Combined Cycle – Roseville	Preconstruction	160	Placer	31.46
Russell City – Calpine	On Hold	600	Alameda	10.90
San Joaquin Valley Energy Center – Calpine	On Hold	1,087	Fresno	30.29
Tesla Combined Cycle - FPL	On Hold	1,120	Alameda	1.98
Three Mountain - Covanta	On Hold	500	Shasta	137.37
Valero Cogen. Unit 2	Construction On Hold	51	Solano	10.63
Walnut Energy Center - Turlock Irrigation District	Construction	250	Stanislaus	14.28

Source: California Energy Commission, Energy Facilities Siting / Licensing Process. http://www.energy.ca.gov/sitingcases/index.html

Table V-3: Impacted Federal lands by Agency and Department

Agency	Area	Total
Army (DOD)	Camp Parks Military Reservation	166
	Fort Ord Military Reservation (Closed)	8,119
	Total	23,742
National Wildlife Refuge (FWS)	Don Edwards San Francisco Bay National Wildlife Refuge	549
	Kesterson National Wildlife Refuge	3,304
	Merced National Wildlife Refuge	537
	San Luis National Wildlife Refuge	351
	Total	4,741
Navy (DOD)	Concord Naval Weapons Station	1,104
Public Domain Land (BLM)		3
Wildlife Management Area (FWS)	Grasslands Wildlife Management Area	12,593
Total		**42,183**

Source: FWS data files.

VI REGIONAL ECONOMIC IMPACTS

VI.1 METHODOLOGY

The distributional effects of critical habitat designation are quantified using IMPLAN Economic Modeling Software.[81] The IMPLAN Model is a widely used tool for analysis of economic events such as a change in industrial output. IMPLAN was developed by the U.S. Forest Service, which continues to use it today, and is now also used by 1,500 agencies and companies, including the San Diego Association of Governments, the California Energy Commission, the California Departments of Finance, Transportation, Water Resources, and Labor and Employment, San Diego State, Stanford, U.C. Berkeley, and numerous private consulting companies.[82]

The core of IMPLAN is an input-output model. This type of model traces the "multiplier effect" of an industry making purchases from other industries.[83] The economy is described by 509 IMPLAN industry sectors, which are based on the North American Industry Classification System (NAICS) and the Bureau of Economic Analysis (BEA) commodity classifications. "Direct effects" are the changes in final demand being modeled (the goods and services produced or purchased from an industry). "Indirect effects" estimate inter-industry purchases. Regional purchase coefficients are used to estimate the proportion of inter-industry purchases occurring within the study area. In addition to the interactions between the 509 IMPLAN industries, "induced effects" estimate the impact of household spending caused by the change in final demand.[84] In the table and discussion that follow, the sum of indirect and induced effects are referred to as secondary effects.

Critical habitat designation reduces the construction of new housing, as described in Section IV. IMPLAN is used to describe how this decrease in new home construction results in a decrease in the demand for inputs from other industries. The change in final demand for new housing construction is calculated as the product of building costs per house multiplied the change in number of houses built. The calculation of building costs for each census tract is described in Section IV.2.

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[81] MIG, Inc., IMPLAN Professional Version v.2.0.1024, 1997-2004.

[82] http://www.implan.com/references.html

[83] For a detailed discussion of this modeling method see, Ronald Miller and Peter Blair, *Input Output Analysis, Foundations and Extensions*, New Jersey: Prentice Hall.

[84] Direct impacts – the direct purchases by the facility under study – and indirect impacts –the purchases made by the firms supplying the facility – are captured in the standard input-output model. Induced impacts – purchases by employees of the facility and indirect firms – are captured when the model is "closed" with respect to households. The version of IMPLAN used here is closed.

Contra Costa, Monterey, and San Benito were selected for IMPLAN analysis because they are projected to incur the largest change in residential construction demand. The change in final demand for residential construction in these counties represented greater than or equal to 0.1% of the county's pre-designation industry revenue.[85] The change in building costs are aggregated for the three counties and annualized. Note that in this analysis, the direct effects are the costs associated with the construction of new homes which is different from the price paid by homebuyers for a new home. Restricting the supply of new homes may increase revenue to home sellers, but it will decrease the demand for inputs needed to construct new homes.

In addition to the IMPLAN model of the impacts on new home construction, the distributional impacts of CHD resulting from mitigation costs and a change in home prices are discussed below.

VI.2 RESULTS

Table VI-1: Secondary Impacts of Designation demonstrates that the secondary impacts from decreased new home construction are small relative to the industry output of the three-county region. Critical habitat designation of the California tiger salamander has little effect on the regional economy. Total annual industry output is reduced by approximately $2.6 million directly and another $1.7 million indirectly. These combined reductions represent only less than 0.01 percent of the region's output. Included among the most affected industries are wholesale trade and architectural/engineering services.

Note that mitigation costs are not accounted for in this analysis. Mitigation costs, principally land acquisition costs, are incurred by the individuals or businesses developing the land. If the land developers do not currently own the land, these costs may be borne by the landowners through a decrease in land price. The mitigation expenditures are a transfer to a conservation bank, i.e., a transfer from one landowner to another or a transfer from a land developer to a landowner. At the census tract level of examination, mitigation expenditures flow out of the census tract and are a cost to producers. Regionally, however, mitigations costs are a transfer that would have minimal distributional effects.

In IMPLAN, the decrease in dollars spent on new housing construction results in decreased spending by the employees in the construction industry. IMPLAN allocates a large portion of this decrease in spending to "owner-occupied dwellings" and "real estate." Note that another larger group of consumers may increase spending in "owner-occupied dwelling" as the supply of housing is restricted and home prices increase. This group of consumers may be diverting money from entertainment, travel, or other industries in response to higher mortgage payments. These dollars flow to home sellers, who in turn may spend more on entertainment, travel, or other activities. In this regard, the diversion of one group of consumer expenditures to new housing may result in another group of consumers spending more on other activities.

[85] The fourth highest was Alameda, where impacts were only 0.093% of pre-designation revenue.

Table VI-1: Secondary Impacts of Designation

Industry[86]	Study Area Data: Industry Output	Model Results: Direct Effects	Model Results: Secondary Effects[87]	Impacts as a Percent of Output
	(1)	(2)	(3)	(4)=((2)+(3))/(1)
New residential 1-unit structures- nonfarm	2,129,212,000	-2,587,375	0	-0.12%
Owner-occupied dwellings	4,647,627,000	0	-119,027	0.00%
Wholesale trade	2,925,517,000	0	-113,980	0.00%
Motor vehicle and parts dealers	1,040,991,000	0	-70,462	-0.01%
Architectural and engineering services	1,199,532,000	0	-66,206	-0.01%
Real estate	5,925,506,000	0	-65,591	0.00%
Food and beverage stores	1,330,143,000	0	-53,586	0.00%
Total, All Industries[88]	100,923,703,000	-2,587,375	-1,659,298	0.00%

[86] Only industries with "Total Effects" greater than $50,000 are listed in this table.

[87] "Secondary Effects" include indirect and induced effects.

[88] Includes industries with impacts less than $50,000 in addition to the industries listed above.

VII ECONOMIC IMPACTS ON SMALL BUSINESSES

According to the Regulatory Flexibility Act, as amended by the Small Business Regulatory Enforcement Fairness Act, an agency has to determine whether proposed legislation will have a "significant economic impact on a substantial number of small entities."[89] There are three categories of entities: small business, small government, and small nonprofit organizations. The impacts on non-profits and small governments are expected to be negligible and are not examined in this analysis.

The effects of CHD on small businesses in new home construction, however, are examined. In some census tracts, the quantity of new housing decreases as a result of CHD. This results in decreased revenue to home construction. The impact to the new home construction industry is characterized as the decrease in the number of housing units multiplied by the average building cost per housing unit. The change in building costs is calculated for each census tract and then summed by county. This is conservative, as some construction firms may actually gain from an increase in housing price when the supply of housing is restricted.[90] In this analysis, the total but-for revenue is equivalent to building costs per house multiplied by the pre-regulation projected number of housing units. Table VII-1: Impact of CHD on New Home Construction Revenue summarizes the revenue loss by county.

To isolate the revenue losses attributable to small businesses we examined the share of new housing construction permits reported in Sacramento County.[91] As shown in Table VII-2: Sacramento Building Permits For Single Family Dwellings, By Contractor, small businesses accounted for 22.4 % of permits in 2004.

To estimate the number of affected small businesses, the number of houses built per small firm was calculated. Next, the number of housing units lost to small businesses was calculated as the percent housing permits to small firms multiplied by the change in housing units from CRA's housing model. Then, the number of lost housing units attributable to small firms was divided by the average number of houses per small firm. This provides an estimate of the number of affected small businesses. These calculations are presented in Table VII-3: Small Business Impacts From Residential Construction and Table VII-4: Small Business Impacts From Residential Construction.

As shown in the tables, the annual number of affected small firms is less than one for all counties examined. Counties not listed have even smaller small business losses. Consequently, less than two small firms are projected to suffer annual revenue losses equal to their expected annual revenues. In view of expected home price increases, it is

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[89] EPA, "Revised Interim Guidance for EPA Rulewriters: Regulatory Flexibility Act as Amended by the Small Business Regulatory Enforcement Fairness Act," 29 March 1999, p.11.

[90] On one hand, there a fewer homes for construction companies to build; on the other, if construction companies are selling the houses to consumers, rather than being hired by another company, then they will obtain the benefits of increased price.

[91] Sacramento County serves as a proxy for the effect counties for both practical and empirical reasons. The county maintains electronic, readily-available (at a price) permit records. The county is also home to a large number of small businesses.

possible that demand for these projects will increase.[92] In addition, rising home prices generate greater demand for home remodel projects likely to be met by small firms.

[92] If two firms close in the first year, then these same two firms will be affected in subsequent years; that is, the number of small firms supplying homes will decrease by two for the entire study period. This new number of small firms will not decrease every year.

Table VII-1: Impact of CHD on New Home Construction Revenue

County	Annual Pre-regulation Revenue	Annual Change in Revenue	Annual Change in Housing Units
Contra Costa	$1,404,125,958	-$1,821,285	-4.63
Alameda	$1,840,515,586	-$1,703,373	-4.20
Monterey	$524,234,525	-$613,431	-2.49
Fresno	$1,592,435,958	-$483,513	-0.94
Santa Clara	$2,048,695,658	-$178,977	-0.56
San Benito	$70,854,432	-$152,659	-0.64
Stanislaus	$869,921,163	-$81,707	-0.34
Solano	$592,356,242	-$71,959	-0.29
Calaveras	$81,351,998	-$50,243	-0.29
Madera	$269,866,011	-$46,368	-0.25
Merced	$297,345,305	-$37,012	-0.24
San Joaquin	$1,134,421,990	-$21,958	-0.07
Sacramento	$2,761,740,751	-$11,891	-0.04
Tulare	$532,238,043	-$9,166	-0.06
Yolo	$336,202,280	-$7,998	-0.05
Amador	$14,151,943	-$5,578	-0.03
San Luis Obispo	$640,255,341	-$551	0.00
Kings	$112,763,999	-$392	0.00
Mariposa	$19,403,429	-$376	0.00
Kern	$1,332,732,428	-$118	0.00

Table VII-2: Sacramento Building Permits For Single Family Dwellings, By Contractor[93]

Firm	Number of Permits	Percent of All Permits	Cumulative Percentile	Size Category[94]
	(1)	(2)=(1) / sum((1))	(3)	(4)
1.	117	19.60%	19.60%	Large
2.	62	10.39%	29.98%	Large
3.	57	9.55%	39.53%	Large
4.	45	7.54%	47.07%	Large
5.	39	6.53%	53.60%	Large
6.	32	5.36%	58.96%	Large
7.	27	4.52%	63.48%	Large
8.	23	3.85%	67.34%	Small/Unknown
9.	22	3.69%	71.02%	Large
10.	20	3.35%	74.37%	Large
11.	19	3.18%	77.55%	Small/Unknown
12.	18	3.02%	80.57%	Large
13.	16	2.68%	83.25%	Large
14.	13	2.18%	85.43%	Small/Unknown
15.	10	1.68%	87.10%	Small/Unknown
16.	7	1.17%	88.27%	Small/Unknown
17.	4	0.67%	88.94%	Large
18.	4	0.67%	89.61%	Large
19.	3	0.50%	90.12%	Small/Unknown
20.	2	0.34%	90.45%	Small/Unknown
21.	2	0.34%	90.79%	Small/Unknown
22.	2	0.34%	91.12%	Small/Unknown
23.	2	0.34%	91.46%	Small/Unknown
24.	2	0.34%	91.79%	Small/Unknown
25.	1	0.17%	91.96%	Small/Unknown
26.	1	0.17%	92.13%	Small/Unknown
27.	1	0.17%	92.29%	Small/Unknown
28.	1	0.17%	92.46%	Small/Unknown
29.	1	0.17%	92.63%	Small/Unknown
30.	1	0.17%	92.80%	Small/Unknown

[93] Does not include owner additions or remodels. Data are from the final week of each month, April, 2004-April, 2005.

[94] Revenue figures were obtained from internet searches for company sales revenue. We are assuming any company whose data we were unable to attain is small. This is very conservative.

Firm	Number of Permits	Percent of All Permits	Cumulative Percentile	Size Category[94]
31.	1	0.17%	92.96%	Small/Unknown
32.	1	0.17%	93.13%	Small/Unknown
33.	1	0.17%	93.30%	Small/Unknown
34.	1	0.17%	93.47%	Small/Unknown
35.	1	0.17%	93.63%	Small/Unknown
36.	1	0.17%	93.80%	Small/Unknown
37.	1	0.17%	93.97%	Small/Unknown
38.	1	0.17%	94.14%	Small/Unknown
39.	1	0.17%	94.30%	Small/Unknown
40.	1	0.17%	94.47%	Small/Unknown
41.	1	0.17%	94.64%	Small/Unknown
42.	1	0.17%	94.81%	Small/Unknown
43.	1	0.17%	94.97%	Small/Unknown
44.	1	0.17%	95.14%	Small/Unknown
45.	1	0.17%	95.31%	Small/Unknown
46.	1	0.17%	95.48%	Small/Unknown
47.	1	0.17%	95.64%	Small/Unknown
48.	1	0.17%	95.81%	Small/Unknown
49.	1	0.17%	95.98%	Small/Unknown
50.	1	0.17%	96.15%	Small/Unknown
51.	1	0.17%	96.31%	Small/Unknown
52.	1	0.17%	96.48%	Small/Unknown
53.	1	0.17%	96.65%	Small/Unknown
54.	1	0.17%	96.82%	Small/Unknown
55.	1	0.17%	96.98%	Small/Unknown
56.	1	0.17%	97.15%	Small/Unknown
57.	1	0.17%	97.32%	Small/Unknown
58.	1	0.17%	97.49%	Small/Unknown
59.	1	0.17%	97.65%	Small/Unknown
60.	1	0.17%	97.82%	Small/Unknown
61.	1	0.17%	97.99%	Small/Unknown
62.	1	0.17%	98.16%	Small/Unknown
63.	1	0.17%	98.32%	Small/Unknown
64.	1	0.17%	98.49%	Small/Unknown
65.	1	0.17%	98.66%	Small/Unknown
66.	1	0.17%	98.83%	Small/Unknown
67.	1	0.17%	98.99%	Small/Unknown

Firm	Number of Permits	Percent of All Permits	Cumulative Percentile	Size Category[94]
68.	1	0.17%	99.16%	Small/Unknown
69.	1	0.17%	99.33%	Small/Unknown
70.	1	0.17%	99.50%	Small/Unknown
71.	1	0.17%	99.66%	Small/Unknown
72.	1	0.17%	99.83%	Small/Unknown
73.	1	0.17%	100.00%	Small/Unknown
Total	**597**	**100.0%**		
Small Businesses	**134**	**22.4%**		

Source: Department of Building Inspection, Municipal Services Agency, Sacramento County

Table VII-3: Small Business Impacts From Residential Construction

County	Proportion of Houses built by Small Businesses[95]	Total Revenue, Annualized[96]	Total Housing Units, Annualized[97]	Average Building Cost	Average Revenue per Small Business[98]
	[1]	[2]	[3]	[4]=[2]/[3]	[5]
Contra Costa	22%	$1,404,125,958	3,747	$374,740	$797,592
Alameda	22%	$1,840,515,586	6,158	$298,900	$774,223
Monterey	22%	$524,234,525	2,289	$228,978	$716,285
Fresno	22%	$1,592,435,958	7,669	$207,657	$846,499
Santa Clara	22%	$2,048,695,658	8,551	$239,575	$785,805
San Benito	22%	$70,854,432	321	$220,569	$640,113

Table VII-4: Small Business Impacts From Residential Construction

County	Annual Houses built per Small Business	Annualized change in number houses[99]	Annualized change in number of houses to small businesses	Number of affected Small Businesses
	[6]=[5]/[4]	[7]	[8]=[1]*[7]	[9]=[8]/[6]
Contra Costa	2.10	-4.60	-1.00	-0.50
Alameda	2.60	-4.20	-0.90	-0.40
Monterey	3.10	-2.50	-0.60	-0.20
Fresno	4.10	-0.90	-0.20	-0.10
Santa Clara	3.30	-0.60	-0.10	0.00
San Benito	2.90	-0.60	-0.10	0.00

[95] From Table 2, part A, based on data from Department of Building Inspection, Municipal Services Agency, Sacramento County.

[96] From CRA's housing model.

[97] From CRA's housing model.

[98] RMA data on revenue by size class and D&B data on number of firms in each size class.

[99] From CRA's housing model.

VIII WELFARE IMPACTS OF CRITICAL HABITAT DESIGNATION

The model of urban growth and the markets for land and improvements to land is adapted from the standard Alonso-Muth-Mills model of urban economics. The approach taken in this study is a partial equilibrium analysis for various portions of the overall critical habitat. Given the relatively small land and housing price changes resulting from critical habitat, together with the localized nature of housing supply and demand, the use of a partial equilibrium approach seems justified.

At each location, the housing developer is assumed to solve the following maximization problem:

$$\max_{H,L,\lambda} pH - k(H) + \lambda(\bar{N} - HL)$$

where p is the price of housing (taken as constant by an individual developer), H is the number of housing units constructed, k is the cost of building H units of housing, L is the amount of land per housing unit, and $\bar{N}$ is the amount of developable land at the location. Landowners earn rents equal to λ, which is determined in equilibrium. The profit-maximization conditions for the developer's problem are as follows:

$$H : p(H,L) - k_H - \lambda L = 0$$
$$L : p_L - \lambda = 0$$
$$\lambda : \bar{N} - HL = 0$$

The second term indicates that the price of land will equal the consumer's marginal valuation of lot size in equilibrium. Rearranging the first two equations, it follows that

$$p_L = \frac{p - k_H}{L}.$$

This expression implies that the intensive margin value of land (p_L) will equal the extensive margin value of land ($\frac{p - k_H}{L}$) when the quantity of developable land is fixed by geography or regulation. In this scenario, further limitations on the stock of developable land will increase the price of housing and increase the price of developable land.

When the amount of new housing is also limited by regulation, the developer's profit maximization problem becomes

$$\max_{H,L,\lambda,\mu} pH - k(H) + \lambda(\bar{N} - HL) + \mu(\bar{H} - H).$$

The first-order conditions for this problem are

$$p(H,L) - k_H - \lambda L - \mu = 0$$
$$p_L - \lambda = 0$$
$$\bar{N} - HL = 0$$
$$\bar{H} - H = 0$$

The first result of interest is to develop a test for rationing of new housing. From the first order conditions in the housing-rationed scenario, we see that

$$\lambda = p_L > \frac{p - k_H}{L} \text{ if } \mu > 0 .$$

Thus, when housing is rationed the intensive margin value of land will be less than the extensive margin value. A comparison of p_L and $\frac{p - k_H}{L}$ is equivalent to a test for rationing of the new housing stock.

In the empirical analysis, two special cases of these scenarios are used to measure the impacts of critical habitat designation. In the first approach, housing is assumed to be rationed and lot size fixed. Since density cannot adjust and the stock of land is fixed, on-site avoidance requirements can only be accommodated by reducing the housing stock. The second approach makes the opposite assumption that avoidance requirements have no effect on the housing stock, and critical habitat is accommodated entirely through densification. As shown in the comparative statics results, a combination of these two responses may well occur in reality. Understanding impacts in the extreme cases helps to bracket actual welfare changes.

In the event where housing is rationed by regulation and lot size is fixed, the housing market equilibrium can be described with the aid of the following figure:

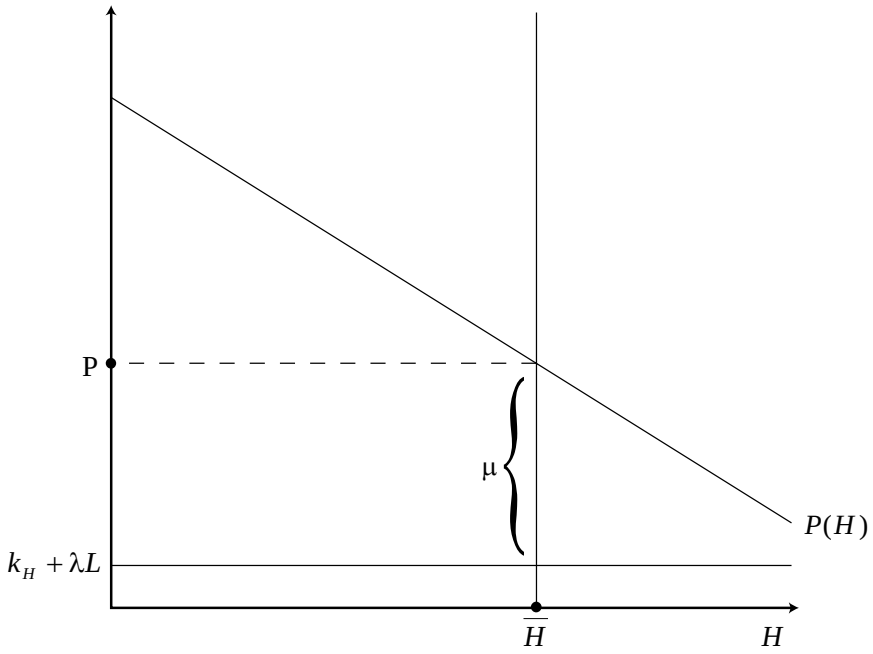

Figure 7: Rationed-Housing Model

Critical habitat designation has three main effects on consumer and producer welfare. First, critical habitat tightens the housing constraint, resulting in higher housing prices and lost rents to developers and landowners. Second, mitigation requirements drive up the marginal cost of housing development, subtracting from the rents earned through the production of scarce housing. Third, the need for Section 7 consultations can delay the completion of housing projects, resulting in surplus losses to consumers and producers.

When the number of housing units are unaffected by critical habitat and all adjustments occur through reducing consumption of land, the relevant market equilibrium is described by the following figure:

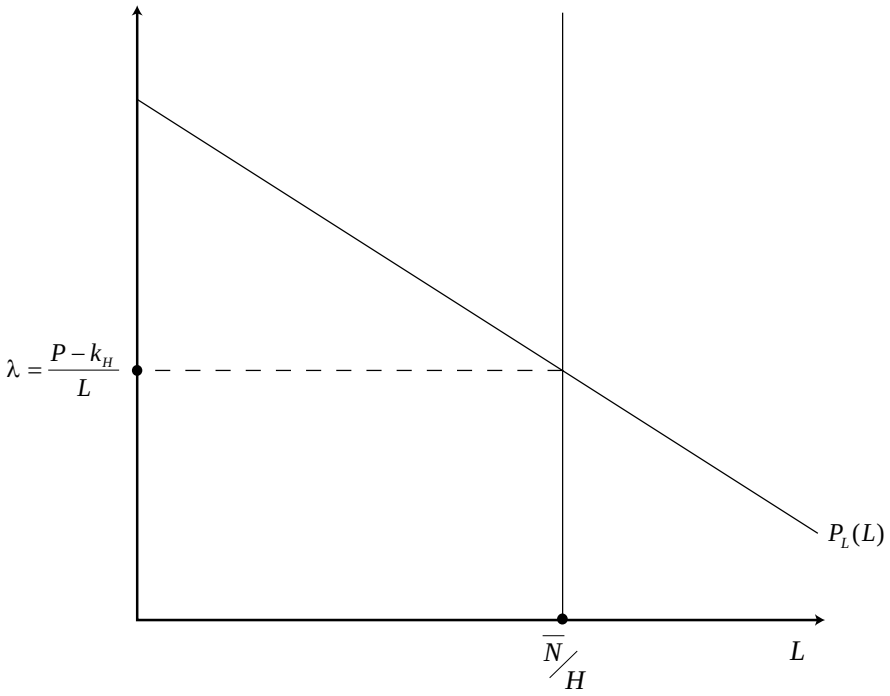

Figure 8: Densification Model

In the densification scenario, critical habitat has similar effects as in the rationed housing scenario: further constraints, increased costs and delay. The next section discussed specification of empirical demand and supply curves to estimate the surplus changes described in this section.

VIII.1 EMPIRICAL ESTIMATION

Empirical estimates of welfare impacts on the land market are based on the conceptual model outlined and on the spatial and socioeconomic data described earlier. This analysis adopts a supply and demand model for housing and land to compute the welfare impacts of designation. The model's primitives are functions describing the producer's marginal cost (the housing supply function), and the marginal benefit to consumers (the demand functions for land and housing). Estimating these functions permits measurement of the regulatory impact.

The analysis can be broken down into several steps:

1. Identify the supply and demand functions and determine the market equilibrium "but for" the regulatory action.
2. Determine the effects of regulation on consumers' marginal benefits and / or producers' marginal costs.
3. Estimate the resulting new market equilibrium and resultant changes in producer and consumer surplus.

The median home price per census tract was obtained from DataQuick, which maintains a database of new home transactions for the state of California. This analysis uses data on

all new homes bought or sold in counties containing critical habitat after 1998 for a total of approximately 245,000 observations.

In some tracts, DataQuick had no observations on new home sales. For these tracts, the median home price and median number of rooms from the 2000 Census were used to approximate new home price and size.[100] Since California home prices have exhibited considerable volatility in recent years, it is necessary to inflate all home prices to present value. This was accomplished using the Freddie Mac Conventional Mortgage Home Pricing Index.

Marshall and Swift's Residential Cost Handbook provides detailed estimates of construction costs per square foot for houses of various size, material (e.g., stud framed, masonry), and quality. DataQuick data provides median square footage estimates per census tract. By using a single-story, stud-framed, stucco house estimates as the basic house profile and assigning construction quality based on median home price, building costs estimates were then generated in each census tract.

In addition to these "vertical" costs of homebuilding, it is also necessary to include development costs (not counting the developer's profit or returns to the landowner). There are two types of development costs that should be considered: "soft" costs and "hard" costs. Soft costs include the cost of design, permitting, marketing and sales. Hard costs of development include costs of grading, construction of local roads, installation of water collection systems, construction of parks, clubhouses and other amenities within the development, bringing utilities to the project, installation of streetlights, and other physical costs. These costs are summarized in table. For purposes of this study, total horizontal costs are assumed equal to 23% of the vertical cost of homebuilding. The sum of the building cost, soft cost and hard cost is the builder cost of new housing.

To determine the supply function for land, this analysis assumes the supply of developable land is fixed within each census tract (the supply curve is vertical.) The pre-regulation supply of land in census tract i is set equal to the total acreage of projected greenfield development:

$$q_0^i \equiv G_i$$

To determine greenfield development in each census tract, we adopt a method used by Landis and Reilly (2003), in which the overall urban footprint (including residential, commercial and public development) equals total new population divided by the gross density of people per acre, scaled to account for infill development.[101] Mathematically, projected greenfield development G is expressed as

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[100] The median number of rooms is defined in the census to include bedrooms, kitchens, living rooms and dining rooms but not bathrooms, closets or hallways. This measure was inflated to square footage by assuming each "gross" room was 380 square feet. This estimate was obtained by an auxiliary regression of the DataQuick data.

[101] John D. Landis and Michael Reilly, "How We Will Grow: Baseline Projections of the Growth of California's Urban Footprint through the Year 2100" (August 1, 2003). Institute of Urban & Regional Development. IURD Working Paper Series. Paper WP-2003-04. http://repositories.cdlib.org/iurd/wps/WP-2003-04

$$G_i = (1 - F_i)\frac{\Delta P_i}{D_i},$$

where F is the infill share, P is population, and D is the gross density of persons per acre.[102]

Determining the change in population requires forecasts of population at the end of the analytic timeframe and estimates of present-day population. Population forecasts are derived from several sources, in order of preference. Wherever available, they were derived from the region's federally-designated metropolitan planning organization (MPO). Typically created by county governments, these forecasts are the preferred source for growth estimates because they are created using detailed knowledge about local growth trends and characteristics, potentially resulting in higher quality data than those obtained with mathematical forecasting techniques.

For counties where such forecasts were not available, the analysis uses projections created by researchers at UCLA and CalTrans for transportation planning.[103]

Present-day population figures were obtained from Applied Geographic Systems, a private supplier of demographic data. These data draw from a wide range of sources, including the Census, Internal Revenue Service, the Bureau of Labor Statistics, the United States Postal Service and the credit reporting agency, Experian.

The demand[104] function is identified using the pre-regulation equilibrium quantity and supply of land, along with an estimate of the elasticity of demand for land derived from the land economics literature. This elasticity is taken to be -1.0. The quantity of land to be developed must equal the fixed supply discussed in the preceding section. The price of land is determined by estimating bid-rent functions for the area designated as critical habitat and using intensive margin land values.

Combining the pre-regulation equilibrium price and quantity of land demand with the elasticity of demand for land identifies the land demand curve. Let η be the elasticity of demand for land. Then,

$$\eta = \frac{dQ}{dP}\frac{P}{Q} \Rightarrow \frac{dP}{dQ} = \frac{p_0}{q_0\eta} \Rightarrow P = \frac{p_0}{q_0\eta}Q + \beta \Rightarrow P = \frac{p_0}{q_0\eta}Q + p_0\left(1 - \frac{1}{\eta}\right).$$[105]

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[102] For brevity, the i subscript is omitted in future formulas. All calculations are indexed at the census tract level.

[103] See "California Travel Trends and Demographics Study," California Department of Transportation, Division of Transportation Planning, Office of State Planning. December 2002.

[104] For purposes of calculating changes in the price of land, the demand curves for land and housing are assumed to be linear. This is a valid assumption since only small deviations around the initial equilibrium typically result from critical habitat designation.

[105] This calculation is valid as long as there is developable land within the census tract, i.e. $q_0 > 0$. If there is no developable land than the impact of designation is zero.

The rationed housing scenario uses a similar method, with prices and quantities expressed in terms of new housing units in each census tract. New housing units are calculated using the same procedure as for the densification scenario, but also accounting for average numbers of persons per household in each census tract, obtained from the 2000 Census.

VIII.2 Spatial Allocation of Economic Activity

A key assumption implicit in the above model is the ability to accurately predict the spatial distribution of housing and land development.

The quantity of development within critical habitat is calculated probabilistically using a mathematical identity. First, divide the census tract enclosing one or more habitat units into one-hectare grid cells, supposing there are *n* cells. The analysis proceeds according to whether the tract is covered by the CURBA model.

If so, then the CURBA model gives a probability that each cell will be developed by 2025. Define the CURBA prediction function $C : \{1,\mathsf{K}\ ,n\} \to [0,1]$ mapping each cell to its respective probability of development. The analysis assumes the identity

$$G = \lambda \sum_{i=1}^{n} C(i)$$

holds—in other words, the sum of probability scores within each census tract, scaled by a fixed multiplier, is identically equal to the total projected greenfield development for that tract. Now solve for λ and let the sets H_A and H_B be those cells that fall in Group A and B critical habitat. Then the expected development in Group A habitat is given by

$$G_A = \lambda \sum_{j \in H_A} C(j),$$

with G_B defined similarly.

IX ECONOMETRICS

A hedonic regression was used to estimate the regional intensive margin value of land within the main regions of the study area. Using DataQuick data on new home sales, we fit the model

$$price = \beta_0 + \beta_1 lotsize + \beta_2 sqft + \beta_3 beds + \beta_4 baths + \beta_5 stories + \boldsymbol{\beta}\mathbf{tract}$$

for each region affected by critical habitat designation, where:

- *lotsize* is the size of the home's lot in square feet;
- *sqft* is square footage of the dwelling unit;
- *beds* is the number of bedrooms;
- *baths* is the number of bathrooms, including half bathrooms;
- *stories* is the number of stories; and
- **tract** is a vector of indicator variables capturing fixed effects for each census tract.

Coefficient β_1 denotes the marginal effect on price of an acre increase in lot size, holding the other major determinants of home price constant. Table IX-1: Results for Sacramento Valley Region through Table IX-4: Regression Results for North Sacramento Area display OLS results for each major region where data are available.[106] Observations were subsampled to eliminate outliers and present a representative estimate of the type of greenfield development expected to be affected by critical habitat designation.

The values contained in these tables denote the intensive margin value of an acre of land. In a perfectly competitive market, these estimates will equal the extensive margin value of land, defined as the producer's margin on new home production, scaled by lot size.[107] If the values differ, they suggest that housing is rationed, lending support to that portion of this analysis as the relevant method of assessing the economic impacts of designation. A secondary analysis reveals that, among the five census tracts with highest projected developed in critical habitat, the extensive margin value exceeded the intensive more than 97% of the time; a *t* test strongly rejects the null hypotheses that the two are equal (*p*-value: 0.000).

[106] Because data availability and completeness vary by county, it was not possible to estimate the full model for every region or county affected by critical habitat designation.

[107] Extensive margin = (price – buildcost) / lot size

Table IX-1: Results for Sacramento Valley Region

Independent variable	Coefficient	Standard error	t	p-value
lotsize	11.0586	0.306163	36.12	0.000
sqft	120.3521	1.307192	92.07	0.000
bed	-2,934.786	823.0983	-3.57	0.000
bath	10,951.78	1,387.389	7.89	0.000
stories	-22,276.99	1,389.719	-16.03	0.000
Constant	89,128.28	3,231.159	27.58	0.000
N	11,171			
R^2	0.7990			

Table IX-2: Regression Results for San Joaquin Valley

Independent variable	Coefficient	Standard error	t	p-value
lotsize	10.2024	0.345923	29.78	0.000
sqft	92.97908	1.435669	64.76	0.000
bed	-1,050.708	873.5263	-1.20	0.229
bath	6,064.542	1,516.707	4.00	0.000
stories	-4,294.984	1,041.246	-4.12	0.000
Constant	132,854	3,680.19	36.10	0.000
N	7,940			
R^2	0.8103			

Table IX-3: Regression Results for Bay Area

Independent variable	Coefficient	Standard error	t	p-value
lotsize	13.2025	0.8651704	15.26	0.000
sqft	158.9862	4.275771	37.18	0.000
bed	9,852.859	2,572.515	3.83	0.000
bath	-925.729	2,121.898	-0.44	0.663
stories		N/A[108]		
Constant	158.9862	4.275771	37.18	0.000
N	3.471			
R^2	.7549			

[108] Variable not available for Bay Area counties.

Table IX-4: Regression Results for North Sacramento Area

Independent variable	Coefficient	Standard error	t	p-value
lotsize	2.8538	0.832012	3.43	0.001
sqft	167.0559	6.03862	27.66	0.000
bed	6,491.808	3,469.398	1.87	0.062
bath	-11,324.87	6,467.951	-1.75	0.081
stories	50,552.91	12,081.52	4.18	0.000
Constant	122,714.4	35,774.9	3.43	0.001
N	380			
R^2	0.8856			